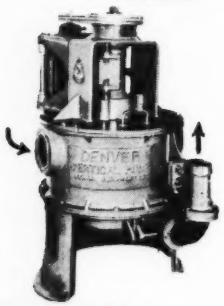
Mining CONGRESS JOURNAL

AMC

DENVER CAN SUPPLY COMPLETE EQUIPMENT FOR YOUR MILL

One Responsibility

Crushers, Screens, Feeders, Ball-Rod Mills, Classifiers, Jigs, Pumps, Samplers, Agitators, Conditioners, Flotation, Thickeners, Filters, Dryers, Ore Testing and Mill Design Services.



DENVER VERTICAL CENTRIFUGAL SAND PUMP . . . for use where

1. Feed is intermittent.
2. Pulp is frothy or air laden.
3. Feed varies in density.
4. Floor space is limited.
5. Plant portability is an advantage.
6. Long life is a factor.
7. Initial cost must be minimum.
8. Feed sump is impractical.

Sizes from ¾" to 4". Also Denver Adjustable Stroke Diaphragm Pumps from 2" to 8", simplex and multiple units.

For complete information, WRITE FOR BULLETIN NO. P10-B5.

How DENVER SRL (Soft Rubber Lined) PUMPS CAN CUT YOUR PUMPING COSTS...for abrasive pulps or tailings

1. POWER COSTS CUT

Denver SRL Pumps often use less than one-half the brake horsepower required by other pumps in similar service. This is the result of simplified design and high efficiency of molded rubber parts. **This means substantial savings for you in power costs and maintenance.**

2. SHUTDOWN TIME REDUCED

Because molded rubber parts are highly resistant to corrosion and abrasion, case history records show where Denver SRL parts lasted up to 15 times longer than parts on pumps previously on the same service. This means increased production, savings for you in maintenance costs—and, more important, reduced down time.

3. A PUMP FOR EVERY JOB

Denver SRL Rubber Lined Pumps are available to you for standard or heavy duty service and with capacities up to 2400 g.p.m. You can choose exactly the right pump that will do your pumping job most efficiently, most economically. Parts for all sizes are kept in stock for fast service.

If you have abrasive or corrosive material to pump, you can make substantial savings by using Denver SRL Rubber Lined Pumps. For complete information about what Denver SRL pumps can do for you, **WRITE TODAY FOR FREE BULLETIN P9-B8. MOST SIZES OF SRL PUMPS IN DENVER STOCK.**

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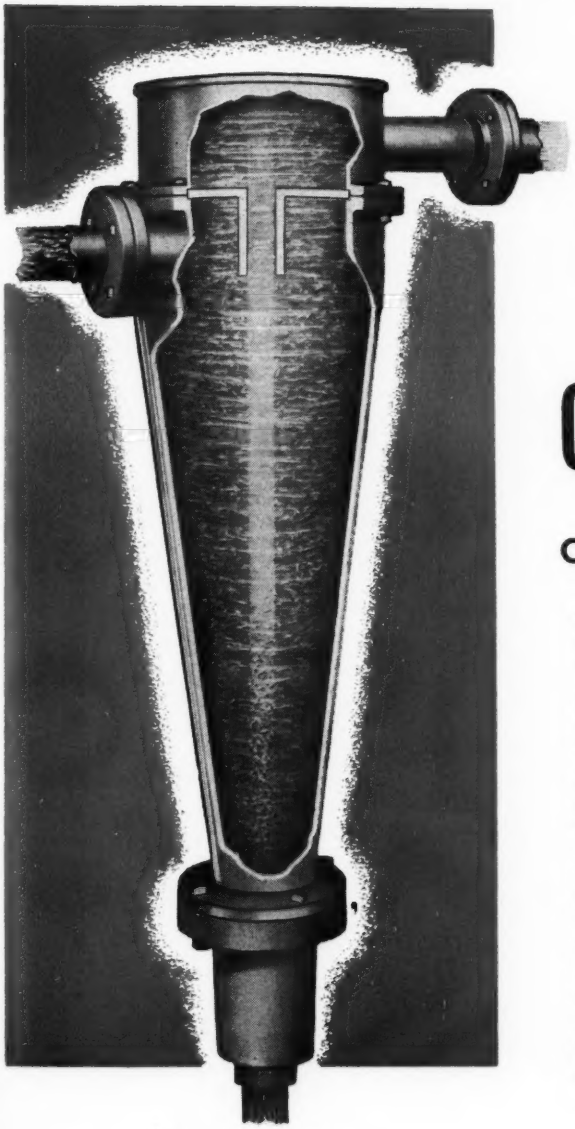


What the

H & P CYCLONES

are doing for the

COAL INDUSTRY

CHECK THESE ADVANTAGES!

- ☐ **Closed circuit operation**
- ☐ **Recovery of fine coal**
- ☐ **Prevention of stream pollution**
- ☐ **Controlled washing water densities**
- ☐ **Conservation of water**
- ☐ **Sharp classification for washing operation**

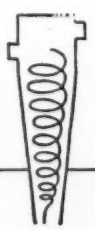
H & P Cyclone installations pay for themselves in unbelievably brief periods . . . by reducing the load to, or entirely eliminating sludge ponds, and by increasing the recovery of salable coal.

Ten years of progressive research and thousands of H & P Cyclones in operation assure you of the finest cyclones engineered into the best designed clarification circuits.

We will gladly arrange for you to visit plants where H & P Cyclones have increased operating profits.

Write for Booklet CT-954.

Heyl & Patterson
INC.



55 FORT PITT BLVD. • PITTSBURGH 22, PA.
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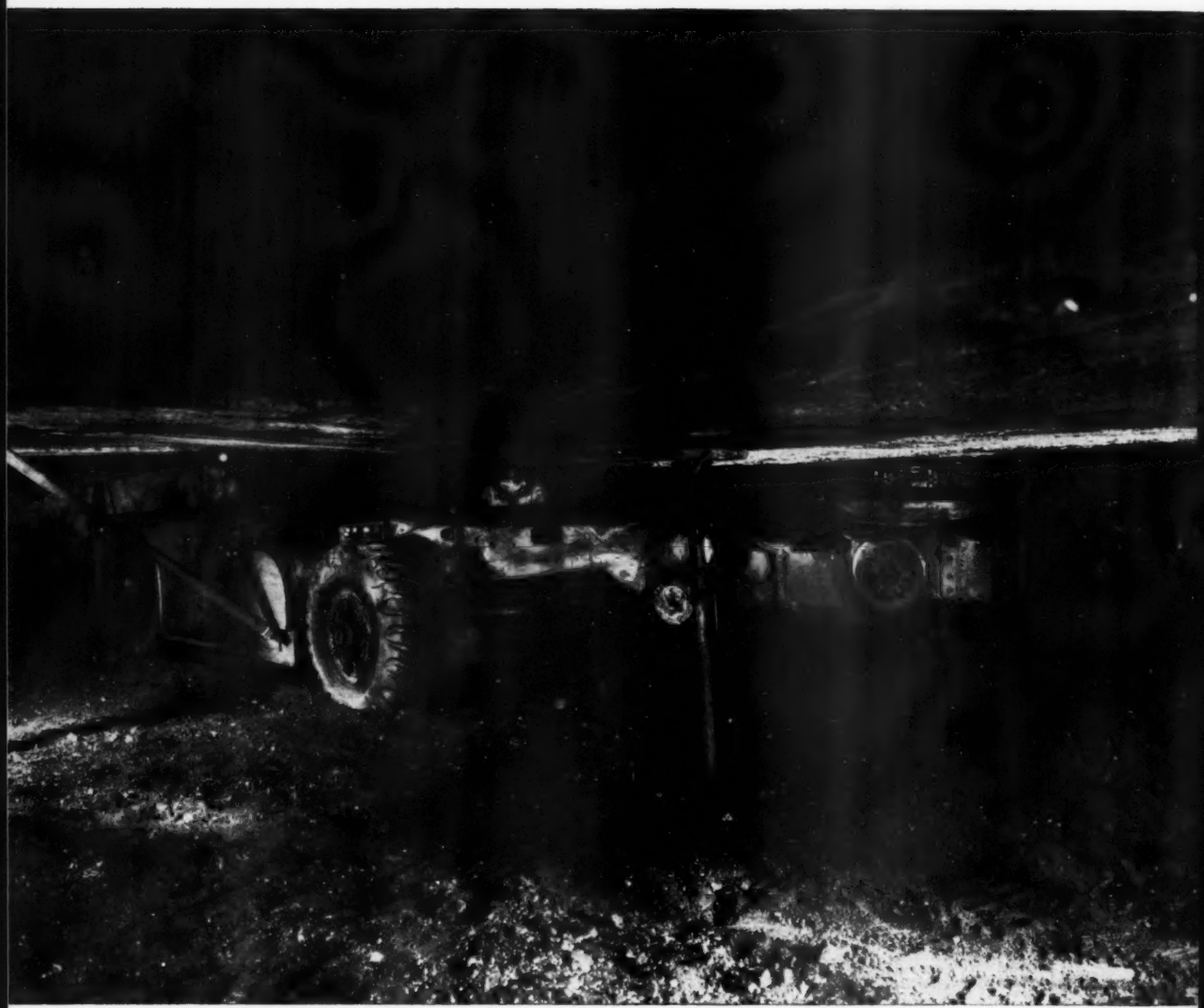
push your coal production UP

with this hard-working JEFFREY team



Jeffrey 70-UR Universal Cutter for bottom, top and shear cuts

Head and cutter can be rotated 360° in either direction and positioned to make any kind of cut, any place in the seam. From one location, the 70-UR Cutter makes a 30-foot horizontal cut (using a 9-foot cutter bar) or a shearing cut 5′5″ to either side of the machine's centerline. No wonder mine superintendents brag about its tonnage-producing ability!

Operators report smooth and positive traction for sumping, even when cutting at extreme range. The 70-UR's wide wheel gauge, long wheel base, low center of gravity and large pneumatic tires give sure-footed stability. Maintenance men say that its rugged construction reduces downtime and cuts upkeep costs.

Jeffrey 81-A Loader for high capacity loading

From both a production and a maintenance standpoint, the 81-A Loader is a superior machine. It is well balanced and flexible, and is easily maneuvered; trams at 137 FPM and can be turned in its own length. The conveyor swings 45° either side of center and elevates properly to load shuttle cars on the straight and in break-throughs. It has a rated capacity of 8 TPM and a maximum capacity of 10 TPM.

Maintenance is simplified on the Jeffrey 81-A Loader because every motor and gear case is a separate, detachable unit. This kind of unit construction is used throughout, resulting in rapid replacements and lower upkeep costs.

Jeffrey 56-FHR Face Drill for shot hole drilling

This single-boom drill provides a high degree of operating flexibility. It is rubber-tire-mounted and self-propelled by two hydraulic motors. Another operates the cable reel. The drilling head can be swung by finger-tip control to any desired position for shot hole placement. Drilling range is 7′2⅝″ vertically and 13′1¾″ horizontally.

The auger can be withdrawn by power without reversing the direction of rotation of the auger. This action clears the hole of all cuttings, leaving it ready for insertion of the powder or blasting cartridge.

OTHER JEFFREY EQUIPMENT FOR UNDERGROUND SERVICE:

Continuous Mining Machines • Conveyors • Shuttle Cars • Locomotives • Fans and Blowers
Descriptive literature sent upon request. The Jeffrey Manufacturing Co., Columbus 16, Ohio

JEFFREY

MINING • CONVEYING • PROCESSING EQUIPMENT
TRANSMISSION MACHINERY • CONTRACT MANUFACTURING

This rope can take it!

MONARCH WHYTE STRAND WIRE ROPE BY MACWHYTE

Wherever you put wire rope to work, you need rope designed and made to earn its way on your toughest requirements, under severest service conditions.

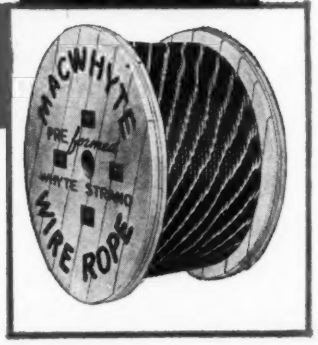
To provide you with exactly the *right* rope for each requirement, MONARCH WHYTE STRAND is made in every wire rope classification, PREformed and Internally Lubricated, Lang Lay or Regular Lay, with Fiber Core or Independent Wire Rope Core.

Put MONARCH WHYTE STRAND to the test on your equipment, you will be more than pleased with its performance.

There is a size and construction to meet each standard and special requirement of mining machines, hoists, and stripping equipment.

Prices, literature, and catalog available through any Macwhyte distributor; or write direct.

MACWHYTE WIRE ROPE



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Ask for MONARCH WHYTE STRAND Bulletin 5425

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VOLUME 42 • NUMBER 6

Mining

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Published Monthly. Yearly subscriptions, United States, Canada, Central and South America, $3.00. Foreign, $5.00. Single copies, $0.30. February Annual Review Issue, $1.25. Entered as Second-class Matter, January 30, 1915, at the Post Office at Washington, D. C.

Indexed regularly by Engineering Index, Inc.

Opinions expressed by authors within these pages are their own and do not necessarily represent those of the American Mining Congress

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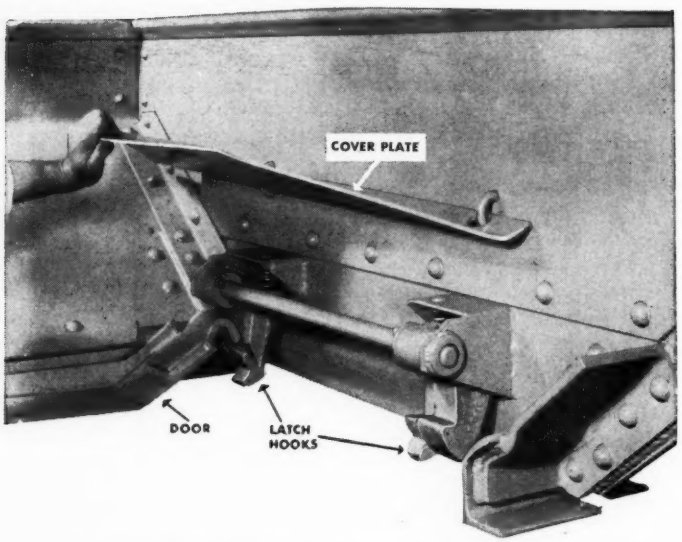
1...

You haul up to 1,000 lbs. more per car with S-D Automatics!

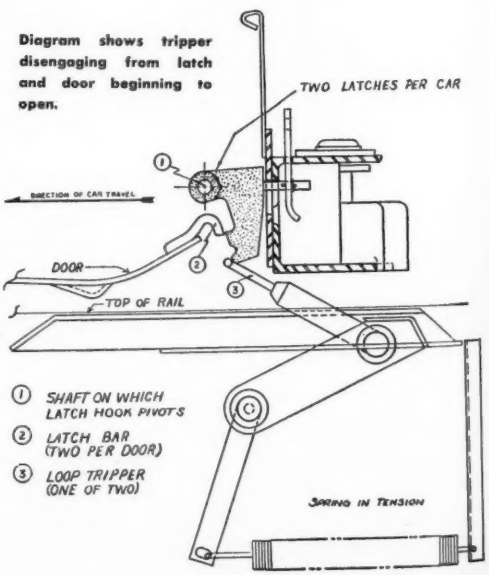
ONE-QUARTER to ½ ton more capacity per car for the same overall dimensions is available only in S-D Automatics because of the construction features of Sanford-Day's exclusive bottom dumping car design. If you were buying, for example, 16 bottom dumping cars of any other make with a 4-ton level full capacity, you would need only 14 S-D Automatics of the same overall dimensions to haul the same tonnage. You would save two cars in every 16 . . . 12½ percent in original investment . . . 12½ percent in maintenance . . . 12½ percent less dead weight to haul. Any one of our sales engineers will demonstrate to your complete satisfaction just how we are able to give you this extra capacity.



● S-D AUTOMATIC car doors open only when exclusive "Twin Safety Latches" are tripped simultaneously. The simultaneous unlatching can be accomplished only by the independently operated pair of tripping devices mounted between rails. They act as two padlocks preventing doors opening accidentally anywhere along the haulage route. Cutaway view at right shows the "Twin Safety Latches" with cover plate raised. Drawing illustrates how each tripping device between the rails unlocks the doors while the trip is moving over the bin.

2...

Only S-D Automatics have "Twin Safety Latches" for Safe and Sure Latching

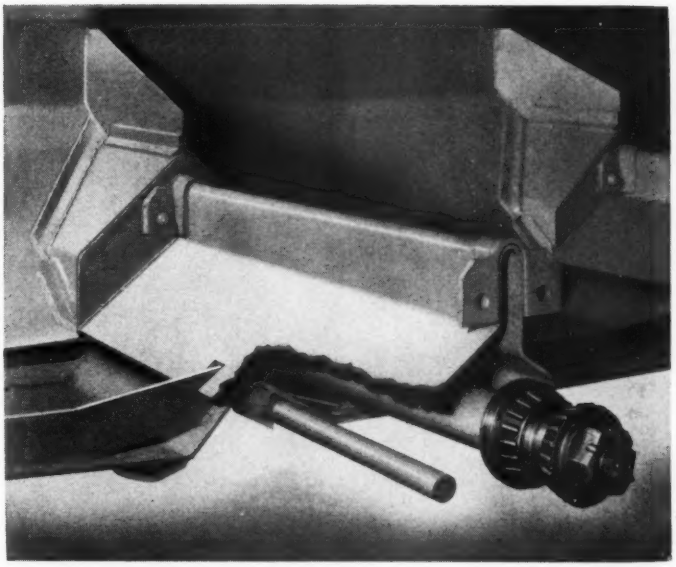


Advantages with S-D "Automatics"

3...

Only S-D Automatics are Safety-Sealed against Dust Leakage

THIS MEANS TWO EXTRA VALUES: (1) Sealed S-D Automatics give you a new, safer in-the-mine operation by eliminating leakage of dust. (2) Sealed S-D Automatics enable you to make a tremendous reduction in track clean-up costs. Photograph at right of a cross section view of the inside of a Sealed S-D Automatic shows you why dust cannot shake down and out through the clearance space between doors and frame.



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. . . there is a BROWNIE to meet every requirement!

BROWNIE rigging hoists, room hoists, haulage hoists, car-spotting hoists, layer loading hoists — hoists for every haulage use. Be sure you obtain the right hoist to meet your requirements. Investigate the BROWNIE line. Also see us for Oil Spray Outfits, Gathering Pumps and Pump Accessories, Blowers, Brownie Rerailers and Derailers. **BROWN-FAYRO DIVISION, Sanford-Day Iron Works, Telephone 3-4191, Knoxville, Tenn.**

SANFORD-DAY

KNOXVILLE, TENNESSEE

SUPER MARKET FOR MINE CARS — all types . . . PRECISION WHEELS . . . BROWNIE HOISTS . . . GISMO SELF-LOADING TRANSPORT that loads in development or production . . . transports . . . supports 2 to 5 jib mounted drills . . . back fills . . . moves boulder rocks . . . makes its own roadways and cleans up completely — a new method of hard rock mining offering a tremendous reduction in cost per ton!

DUDCO Dual-Vane Hydraulic Pump

AURORA Horizontal Split-Case Centrifugal Pump

Find It . . . Get to It . . . Dig It Out . . . Save Time With Power

FLUID POWER

Mining, from strike to full operation, measures profits in time, because time saved can be as important in the profit picture as the grade of ore.

Consider the products made by Divisions of The New York Air Brake Company as the means for saving time, raising efficiency and lowering costs. DUDCO Dual-Vane Pumps and Motors . . . HYDRECO Gear Pumps and Motors, Valves and Cylinders provide the Hydraulic equipment for drilling, cutting, collecting, loading and transfer of ore as well as for Hydraulic Power on conveyors, grinders and shakers at the mill.

The AURORA PUMP and KINNEY MFG. DIVISIONS produce the "right" pump for every Liquid Handling requirement . . . Turbine-type Pumps for water supply . . . Centrifugal Pumps for handling drainage and liquids containing solids . . . Gear and Rotating Plunger Pumps for sludges, slurries and heavy flotation liquids.

KINNEY High Vacuum Pumps bring another vital tool to the refinery. Developing pressures to 0.0001 mm Hg., vacuum processing opens up entirely new vistas to the metallurgist . . . and new economies in refining and the reclaiming of many metals.

More and more, engineers reach for improved techniques by employing the versatility, dependability, time and money-saving performance that distinguish Fluid Power.

Engineers of The New York Air Brake Company are a well-spring of "know-how" on Fluid Power. Get to know more about N.Y.A.B. products and the many new developments in Power Hydraulics, Liquid Handling and High Vacuum Equipment.

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AURORA PUMP DIVISION
Aurora, Ill.
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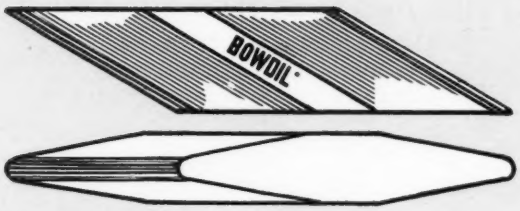
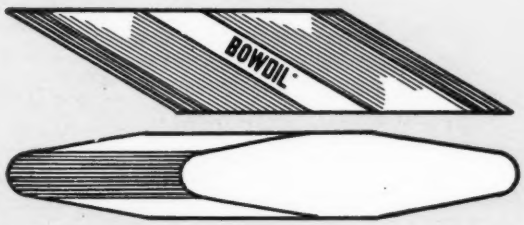
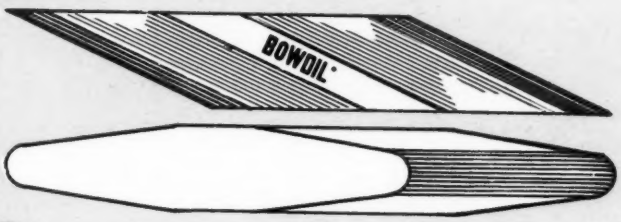


Series 1-1 **REGULAR DIAMOND BIT, designed for use where cutting conditions are not too severe. Saves power, produces coarse cuttings. 1-1 is MEDIUM Temper, 1-1N1 TOUGH, 1-1N2 HARD.**



Series 1-2 **HEAVY DIAMOND BIT is especially designed for severe cutting conditions (Iron Pyrites and Rock). 1-2 is MEDIUM Temper, 1-2N1 TOUGH, 1-2N2 HARD.**

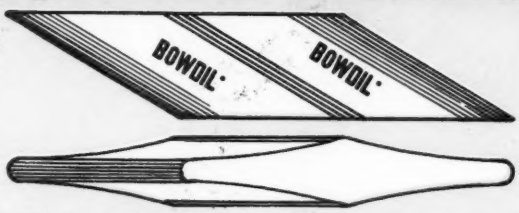


Series 1-6 **LONGWALL BIT is especially designed with a long cutting point for Longwall work. 1-6 is MEDIUM Temper, 1-6N1 TOUGH, 1-6N2 HARD.**

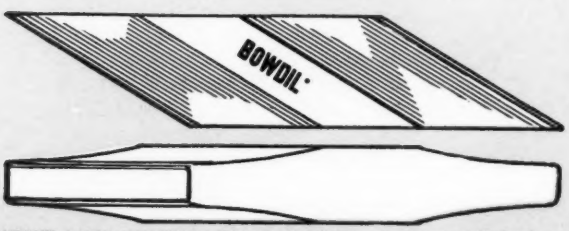
There's a BOWDIL® Bit for every cutting need!

These various types are designed for specific requirements, are made from special alloy steels and are heat treated to three different tempers as listed. Through many years of research on actual conditions in the field, these styles, shapes and hardnesses of Bowdil Bits consistently prove the most popular. We are happy to offer our experience and recommendation for your individual need.

TO HELP YOU RE-ORDER, PLACE YOUR TYPE BIT ON THESE ACTUAL SIZE DRAWINGS



Series 1-11 **REGULAR CONCAVE BIT is designed for the maximum in power savings. Due to the concave shape, side clearance is automatically maintained as the face is worn away, resulting in a more uniform power consumption over the full life of the bit. No. 1-11 is MEDIUM Temper, 1-11N1 TOUGH, 1-11N2 HARD.**



Series 1-29 **HEAVY DUTY CONCAVE BIT has the design features and similar cutting advantages of the Regular Concave, but is made heavier for very severe service. No. 1-29 is MEDIUM Temper, 1-29N1 TOUGH, 1-29N2 HARD.**

ORDER BY NUMBER!

THE BOWDIL CO., CANTON, OHIO

Gentlemen: Rush us

_____ NO. _____ BITS
(Quantity)

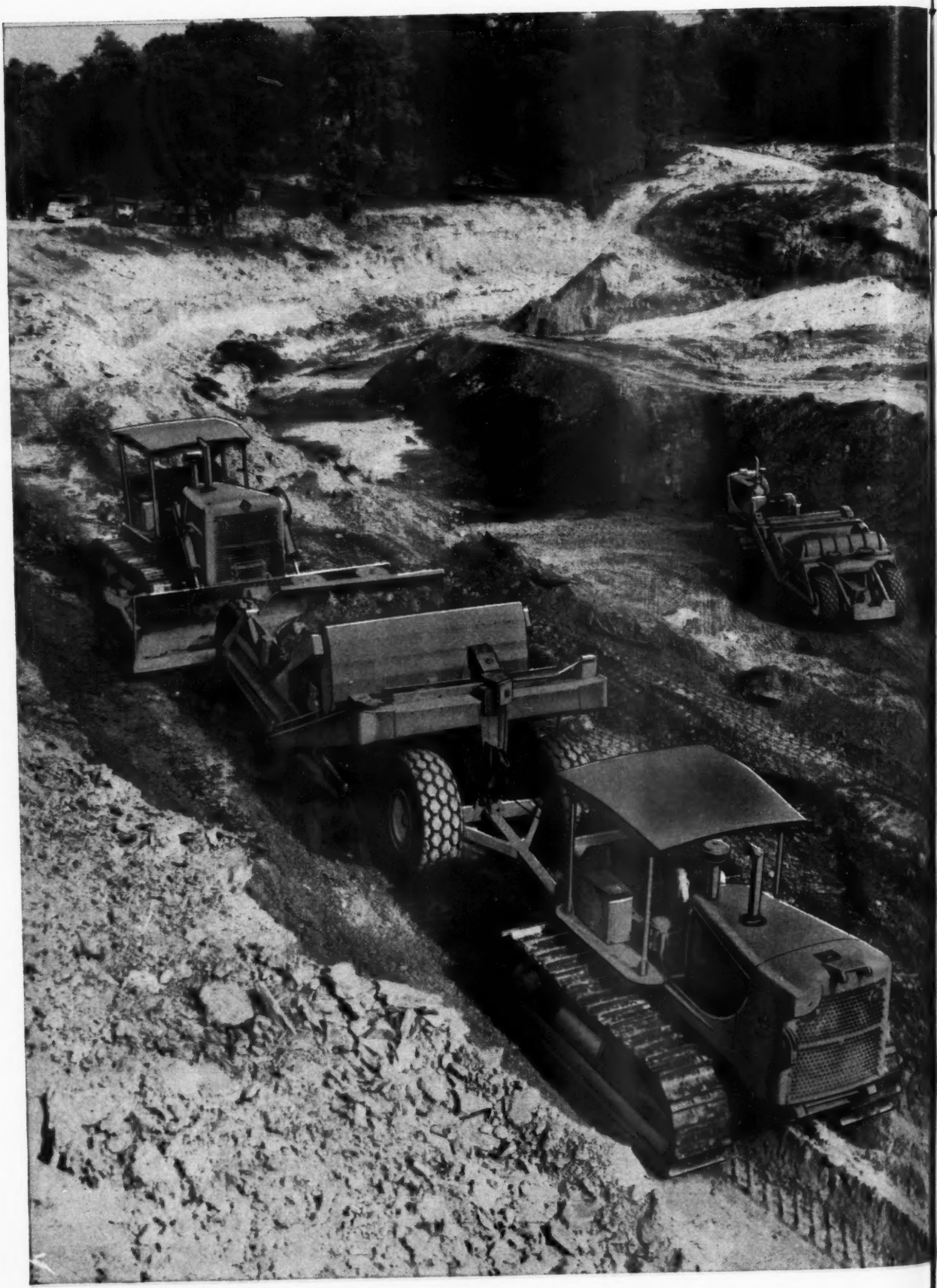
Name _____

Address _____

City _____ State _____

THE BOWDIL COMPANY

Boylan Ave. S. E. Phone GLendale 6-7176
CANTON, OHIO



This Allis-Chalmers HD-21 is general handy man at the Furr Coal Company's mine. It builds and maintains incline ramps between cut and fill areas to provide short haul cycles. With rear-mounted ripper, it loosens overburden when necessary to insure continued, fast loading. It also acts as a stand-by pusher.

Two Allis-Chalmers HD-21 tractors and pull-type scrapers strip overburden, carry it down an incline and spread it in a worked-out section of the mine and return empty up another ramp. By this method, the Furr Coal Company reclaims land without rehandling material. Savings amount to 8¢ a ton or roughly $1.50 for every scraper load.

Furr Coal Company Strips Overburden, Reclaims Land in One Operation

saves 8¢ on every ton of material moved

The mobility of Allis-Chalmers tractors and pull-type scrapers enables the Furr Coal Company, Nelsonville, Ohio, to handle stripping and land reclamation in one operation. As scrapers remove overburden from new deposits, they haul and spread it in a worked-out section of the mine. This eliminates a second handling and saves an estimated cost of 8¢ a ton for land reclamation.

On this operation, overburden consists of earth and clay with very little rock. The big HD-21's have the power to load the 18-yd scrapers—usually without a pusher—and the speed to complete the cycle quickly.

"I've owned other makes of tractors and scrapers," says Mr. Furr, "and I have these because I believe them to be the best." Mr. Furr likes the Allis-Chalmers diesel engine, the construction of the tractor and the fact that it has proven torque converter drive. He also estimates that its thousand-hour lubricating intervals save about 30 minutes' servicing time every shift . . . "and this really adds up to important savings."

Find out how Allis-Chalmers equipment can bring new efficiency to your stripping and reclamation work. See your Allis-Chalmers Construction Machinery dealer.

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

ALLIS-CHALMERS

how to get the most out of HOLLOW DRILL RODS

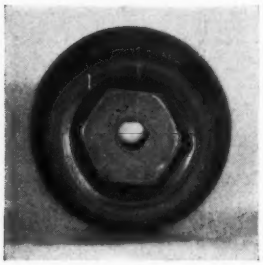
Modern drill rods – especially new *alloy* hollow drill rods like Crucible CA DOUBLE DIAMOND or 4E – give longer drill life than was possible with straight carbon rods. They'll give you lower cost per foot of hole drilled on the job. They will, that is, if you let them. For *abuse* will stop even the best steel from doing its best job. And you pay the price in higher drilling costs.

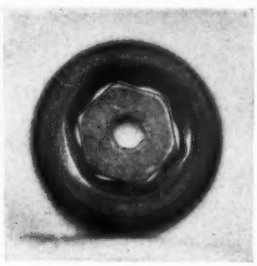
Rods properly racked and stored give better service.

Take, for example, MAINTENANCE:

DRILLS — Pneumatic drills are often so badly in need of repair that good drilling is impossible. Early failure of any rod used in these drills is inevitable. The solution is regular, periodic inspection of all drills and equipment – replacement of worn or damaged parts.

The damaged and worn striking faces of these pistons prevent impact from being transmitted to the rod in a straight line. Rod failure results.





BITS — Keep bits sharp. A dull bit binds in the hole, and drills so slowly that little useful work is performed. But the drill steel must absorb the rugged blows of the hammer.

Proper bit maintenance pays off.

RODS — It's a temptation to store drills by throwing them into one big pile. Resist it. For nicks and surface damage result – drill failures occur at points of damage.

It pays big dividends to make good maintenance a habit. Quality drill steels, like Crucible CA DOUBLE DIAMOND or 4E Alloy Hollow Drill Rods, are made to give long service, lowest cost per foot of hole drilled. They're tough, strong, made to tool steel standards. This *extra* quality assures you of minimum rod breakage, fewer valuable bit losses. But to bring out the best in 'em, you've got to do your part by keeping equipment in shape.

Crucible hollow drill rods are always quickly available in the sizes and types you need. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Reinsulate with U. S. Uskorona and "D. R." Tapes

A cable becomes as good as new when you reinsulate with Uskorona and re-jacket with "D.R." splicing compound. The "D.R." compound provides an outside vulcanized covering. These completely reliable tapes give:

- Extra-tight grip plus high tensile strength.
- They stand up under acid, alkalies and moisture . . . ideal for mining machine cables.
- Dangerous leaks can't occur, because pinholes are impossible.
- Absolutely waterproof.

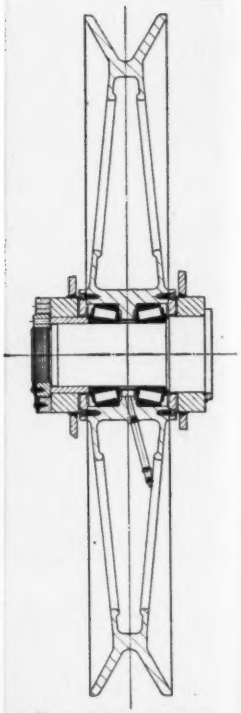
Like all the tapes and splicing compounds in United States Rubber Company's complete line, Uskorona was developed for specific operating conditions, yet can handle a wide range of electrical and general purpose jobs. It exceeds A.S.T.M. specifications.

Get in touch with any of our numerous distributors or one of our 27 District Sales Offices, or write to us at Rockefeller Center, New York 20, N. Y.

US RUBBER

Mechanical Goods Division

United States Rubber



How **THE MARION POWER SHOVEL COMPANY** mounts sheaves on Timken bearings . . . to take radial, thrust loads in all combinations, keep heavy-duty sheaves in positive alignment.

World's largest shovel scoops 90 tons, lifts it 10 stories moves it 290 feet on 34 TIMKEN® bearings

BUILT by the Marion Power Shovel Company, this gigantic "coal miner" moves many tons of overburden per hour for the Hanna Coal Company. With 10 motors controlling the digging cycle of the 90-ton capacity dipper—an additional 4 motors for its 8 powerful cat treads—built-in elevator—auxiliary crane for hoisting equipment aboard—this tremendous earth mover is 100 times larger than the ordinary construction shovel.

34 Timken® tapered roller bearings carry terrific radial and thrust loads in all combinations, at critical points—including swing machinery and all hoist sheaves. Full line contact between rollers and races gives extra load-carrying capacity. And because Timken bearings have case-carburized rollers and races—shock-resistant cores under hard, wear-resistant surfaces—they take heavy shock loads. Designed to roll true, precision manufactured to live up to their design, Timken bearings practically eliminate friction, reduce wear on integral parts. Closures are more effective, too, because Timken bearings keep housings and shafts concentric, keeping lubricant in, dirt, dust, water out.

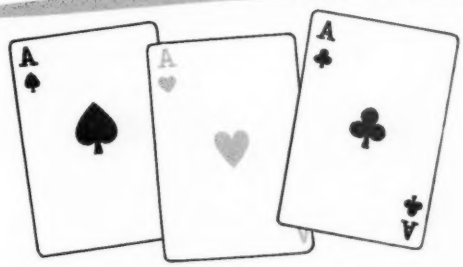
When you buy or build machinery, look for the "TIMKEN" trade-mark on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.

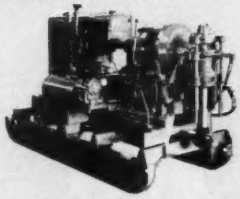
TAPERED ROLLER BEARINGS ROLL THE LOAD

When you're CORE-DRILLING, it's no gamble with these 3 aces in the hole



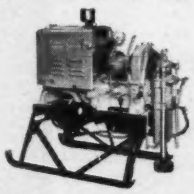
22-HD The rugged, heavy-duty model. Single-line capacity—2,250′ with AWX fittings. Also available as truck-mounted drill or on twin-column mount for underground operation.

1



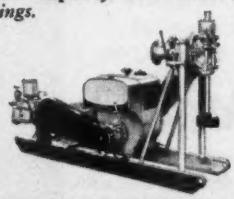
12-B Extremely portable, weighs approximately 1200 lbs. Capacity—1,250′ with EWX fittings. Also available on twin-column mount with air motor drive for underground operation.

2



No. 7 The lightweight, easily transportable model. Can be taken underground or transported by airplane, boat, or even muleback into remote areas. Capacity—500′ with EWX fittings.

3



CONTRACT CORE DRILLING *Sub-surface test borings for mineral prospecting, foundation drilling, and grout hole drilling are available on a contract basis. Highly skilled crews and complete stock of core drills, bits, and accessory equipment are maintained at all times.*

JOY Diamond Core Drills When these three "aces" go into the holes, luck no longer is a factor. They are a sure bet to tell you exactly what is down there. And, at Joy, you can find the right "ace" to do the best job for you.

With capacities ranging from 500 to 4000 feet (the 22-HD, with larger power unit and using multiple lines, has drilled to depths greater than 4300′) there are Joy diamond drills applicable to almost any coring job. And they'll do the best job for you. Here's why . . .

EXTREME PORTABILITY Skid mountings, compact design, and rugged construction make it possible to drag Joy diamond drills into some of the most inaccessible locations.

VERSATILITY Because they are available with either hydraulic or screw-feed swivelheads and with a choice of gasoline, electric or air power, Joy core drills can fit into any drilling program without expensive preparations.

Check your drilling needs against this group of outstanding drills. One of them will be suitable to your needs and it will do an accurate, economical job of proving the mineral value of your property. Write today for literature on the machine you need to **Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Write for FREE Bulletin 86-3

JOY

WORLD'S LARGEST MANUFACTURER OF CORE DRILLS AND MOTORIZED DRILL RIGS SINCE 1851

Consult a Joy Engineer

WSW M5508-86

What's so special about this terminal?

What's so special about the terminal of this AW-22 rail bond?

A bond welder could point to several things.

For example, the husky "clip" that allows him to set the bond firmly in place with a couple of hammer blows.

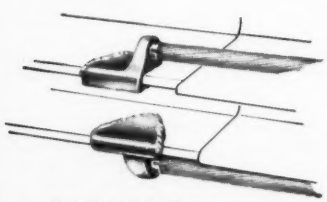
Or the broad flanges that give him room to build up a solid weld between terminal and rail.

Or the easy accessibility of the weld area, whether he's installing the bond above or below the rail base or using it for cross bonding.

These are just a few of the many features that help him do a *better* job *faster* with the AW-22 bond.

See your No. 27 Catalog, or write us direct, for more information on the AW-22 and other fine O-B bonds.

ABOVE RAIL BASE



BELOW RAIL BASE

Ohio Brass

MANSFIELD OHIO, U. S. A.

IN CANADA: CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

4710-M

Only JOY Tungsten Carbide ROCK BITS offer all these features

The results of improved manufacturing techniques

OFFSET DESIGN OF WINGS for drag-free rotation, faster removal of cuttings to permit faster drilling, easy and inexpensive reconditioning.

DEEP SLOTTED CHIP-WAYS allow cuttings to escape readily; the bit does not regrind its own cuttings.

IMPROVED TECHNIQUE FOR BRAZING INSERTS to prevent loss of inserts and to assure maximum drill footage and minimum loss of gauge.

MACHINED FROM SPECIAL ALLOY STEEL and heat treated by an exclusive process to provide high fatigue life and maximum shock resistance. This feature makes the Joy Tungsten Carbide Bit *best for any rock formation.*

CHOICE OF TWO GRADES OF TUNGSTEN CARBIDE—a hard grade for abrasive formations and a medium grade for harder formations.

PRECISION MILLED THREADS insure dimensional uniformity, positive rotation and uniform thread tolerances.

CONCENTRIC PRECISION MILLED SEATING SURFACE permits full contact of bit threads and rod threads. The bit seats firmly against the drill rod upset, radial play is prevented and life of threads and rods is lengthened.

Joy Tungsten Carbide Rock Bits are available in the following gauge sizes:

CROSS TYPE, JHO—1½", 1⅝", 1¾", 1⅞", 2"
CROSS TYPE, JDO—1⅞", 2", 2⅛", 2¼", 2⅜", 2½", 2¾", 3"
X TYPE, JX—3½", 4", 4½"

● *Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.* In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Write for FREE Bulletin 70-3

Consult a Joy Engineer

for AIR COMPRESSORS, ROCK DRILLS, CORE DRILLS, HOISTS and SLUSHERS, MINE FANS AND BLOWERS

WSW M6012-70

JOY

WORLD'S LARGEST MANUFACTURER OF UNDERGROUND MINING EQUIPMENT

Right down the steel production line . . .

Macks HANDLE THE IMPORTANT JOBS

Despite the punishing service, these husky, dependable Macks help keep steel production booming, right down the line. Like all Macks, they're engineered to the job, with extra stamina and staying power built in to meet the most extreme requirements.

If you haul important loads . . . Mack-sized loads . . . on fast long-distance highway runs, on start-and-stop delivery service through heavy city traffic, or operate over terrain where roads are unknown, it will pay you to standardize on Macks. Take advantage of Mack's unmatched experience, production skills and uncompromising standards of workmanship to get your cargoes moved on schedule, at the lowest cost per mile.

See your Mack factory branch or distributor.

FACTS ON MACKS

FIRST—FOR THE FIFTH YEAR! *Again in 1955, Mack was the unchallenged favorite among all diesel trucks—with 42.06% of total sales! The exceptional fuel economy of the Mack Thermodyne® Diesel engine, low maintenance costs, and amazing long life account for Mack's overwhelming preference among truck operators of every size in every field.*

Mack

FIRST NAME FOR TRUCKS

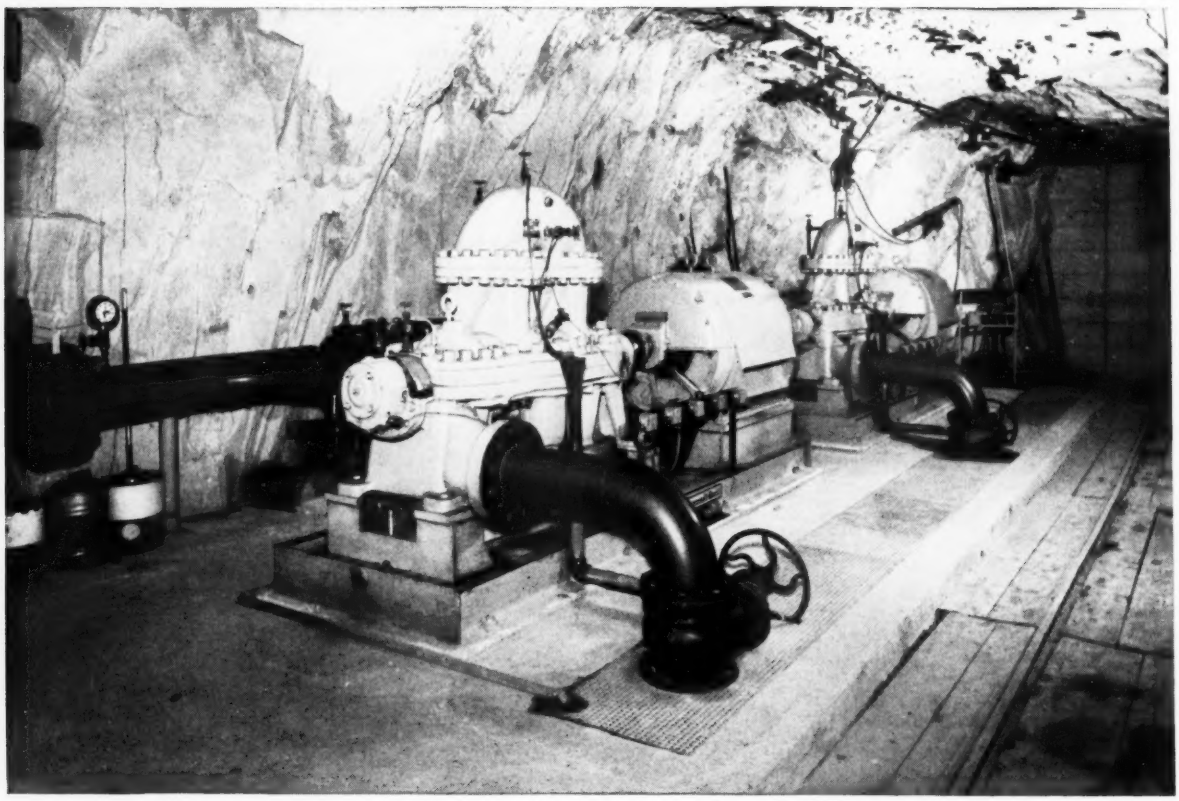
Empire State Building, New York 1, N. Y.
In Canada: Mack Trucks of Canada, Ltd.

At iron and steel mills, Mack dump trucks haul slag from the enormous furnaces. Other Mack trucks shuttle semi-finished materials from one operation to the other on precisely-timed schedules, and deliver finished mill forms to warehouses.

Millions of pounds of steel—girders, window frames, beams, pipe and fastenings—for America's new schools, industrial plants and office buildings are delivered exactly when needed by Macks like the husky lightweight tractor shown on the job here.

Huge Mack dumpers carry tremendous loads of ore from the crater-like open-pit iron mines, climbing steeply spiralling hauling roads, keeping tight schedules 24 hours a day, seven days a week.

Ingersoll-Rand Mine Pumps



Two 6-stage Ingersoll-Rand drainage pumps in the Star Mine at Burke, Idaho. Other I-R pumps in this mine include two 300 hp and two 250 hp multi-stage units, as well as numerous Motorpumps.

...meet exacting demands of drainage service at Star Mine of Bunker Hill Company, operated by Hecla Mining Co.

Installed on the 4000 ft. level of the Star Mine at Burke, Idaho, the two I-R pumps shown above boost water to the 2000 ft. or drainage level of the mine. Driven by 700 hp motors and rated at 1000 gpm each, 2050 ft. head, these units have been giving excellent service.

In the Coeur d'Alene mining area, in which the Star Mine is located, the traditionally fine performance of Ingersoll-Rand mine pumps has resulted in their selection for handling more than 95% of the mine water pumped. The exceptional service record of these units reflects Ingersoll-Rand's many years experience in the design, construction and application of pumps for mine drainage service.

Discuss your next pumping application with your nearby I-R representative. He is qualified to furnish complete information and recommendations.

Ingersoll-Rand

10-362 **11 BROADWAY, NEW YORK 4, N. Y.**

COMPRESSORS • GAS AND DIESEL ENGINES • ROCK DRILLS • PUMPS • TURBO-BLOWERS • AIR AND ELECTRIC TOOLS

You get more Work-ability with "Eucs" in Mines and Quarries

Rear-Dump "Eucs" fit any operation . . . 10, 15, 22, 34 and 50 ton capacities.

Rear-Dump Euclids are built for long life on the toughest jobs. Their simple, rugged construction pays off in less down time for servicing and repairs . . . more work-ability day after day . . . as proved on hundreds of mine, quarry and industrial operations for over twenty years.

There are 5 models with rated payload capacities of 10, 15, 22, 34 and 50 tons. Engines from 128 to a total of 600 h.p. . . . top speeds with full payload up to 36 m.p.h. . . . 5 and 10 speed standard transmission or Torq-matic Drive . . . semi-rigid or spring mounted drive axle . . . standard or quarry type bodies.

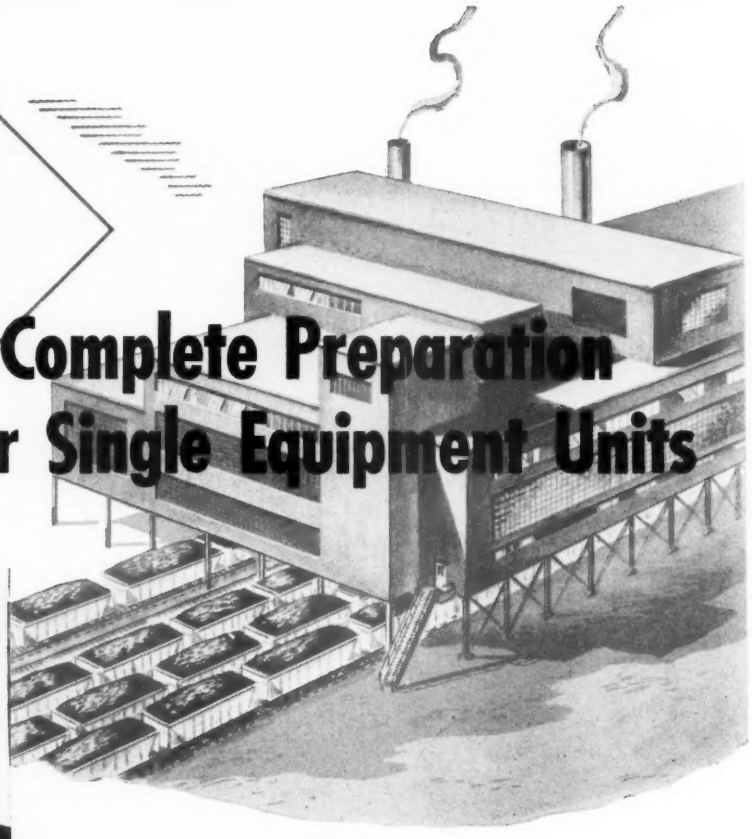
Compare Rear-Dump Euclid performance with your present equipment before you replace or add to your hauling fleet. Your Euclid dealer has helpful facts and figures that show how "Eucs" can cut mine and quarry hauling costs and why ***Euclids are your best investment.***

EUCLID DIVISION, GENERAL MOTORS, Cleveland 17, Ohio

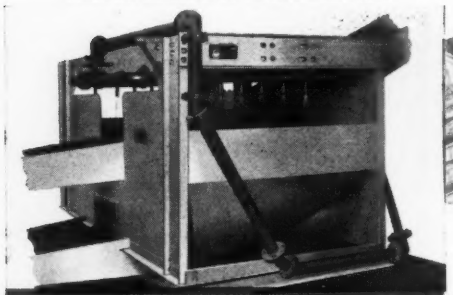
Euclid Equipment

FOR MOVING EARTH, ROCK, COAL AND ORE

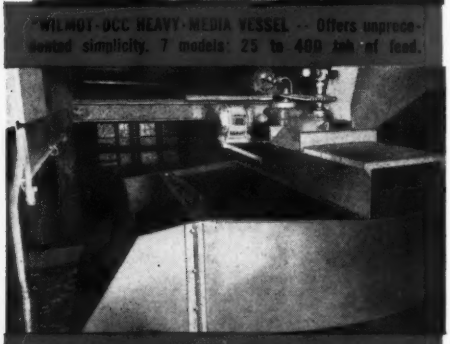
Wilmot Builds Complete Preparation Plants or Single Equipment Units



* U.S. & FOR. PATENTS PENDING. THE ORE & CHEMICAL CORP.



WILMOT-DCC HEAVY-MEDIA VESSEL -- Offers unprecedented simplicity. 7 models: 25 to 400 tons per hr. of feed.



WILMOT CONE CLEANER -- Cleans bituminous down to 10 M; anthracite, Stove to No. 4.

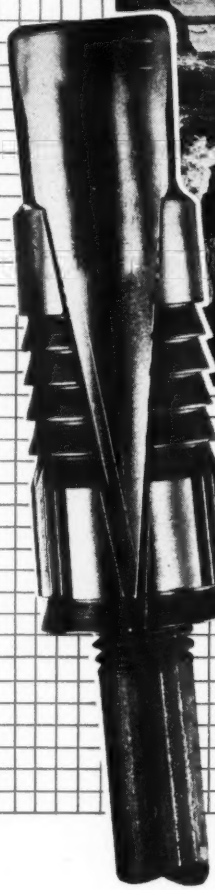
WILMOT CLASSIFIER -- Cleans bituminous (10M x 0); anthracite (−3/64" x +48 M). Also froth flotation.

Automatic Cleaning Units for Every Use. Pilot Plant Test Facilities Available.

For nearly 50 years, Wilmot has been designing, building and equipping coal preparation plants exclusively. A wealth of engineering and construction experience is available to you, whether your requirements are a single unit of replacement equipment or a complete plant. Wilmot furnishes equipment for four coal cleaning processes: heavy media, cone cleaning, classifier, froth flotation. Embodying Wilmot patented controls, they are fully automatic. At our White Haven, Pa., pilot plant, we maintain laboratory and commercial sizes of Wilmot equipment for customers' testing use.

Pilot Plant, White Haven, Pa., houses commercial size Wilmot cleaning units.

WILMOT ENGINEERING CO. HAZLETON, PA. Plant: WHITE HAVEN, PA.



Anyway you look at it

Roof Bolting is PROFITABLE....

From a **SAFETY** angle—bolting reduces number of roof falls resulting in fewer compensable accidents and reduces, in some mines, compensation costs approximately 50%. Some have effected savings on compensation from 3 to 10 cents per ton produced.

From a **VENTILATION** angle—bolting eliminates most of the timber obstruction in the airways and the obstruction of roof falls allowing for increased quantity of air—at less cost.

From a **PRODUCTION** angle—bolting increases production efficiency in most mines from 15 to 70% as equipment can be moved to and from working faces easier and faster. With fewer falls to clean up and timber, and less material handling by production crews, production is increased and costs are reduced materially.

To be as effective as possible—roof bolting calls for thorough knowledge of the roof strata—well planned bolting patterns and cycles—proper selection of bolts and shells—an adequate supply and service program. Being "The Pioneer in Roof Bolting"—**PATTIN MFG. COMPANY**, staffed with experienced roof bolting, mining engineers, is capable of meeting every requirement for quality products and service. Your phone call or letter will get immediate attention.

Shown above is the outstanding **PATTIN** style D-1 expansion shell. Samples of the "D-1" or "D-2" shells will be furnished upon request.

In Western States

PATTIN expansion shells are available and serviced exclusively through Colorado Fuel and Iron Corporation, Denver, Colorado. Western mining companies may contact them direct for information and consultation.

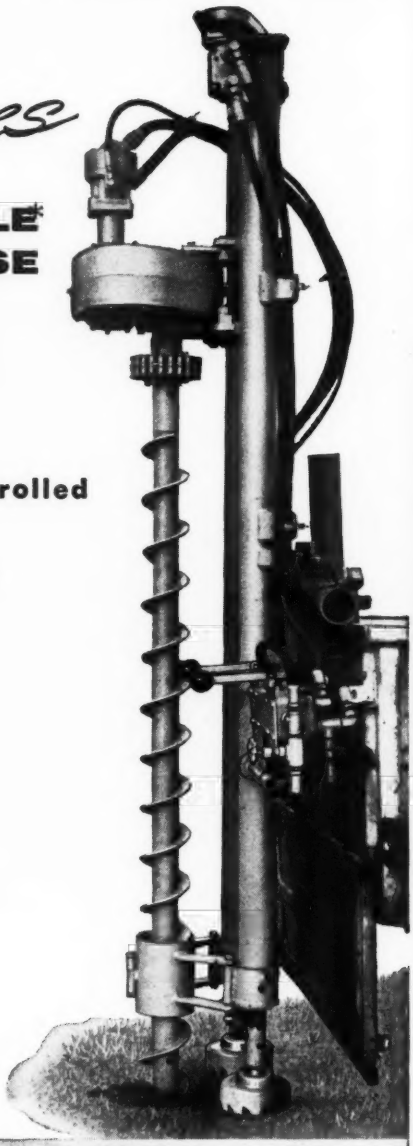
PATTIN MANUFACTURING COMPANY

"68th Year"

MARIETTA, OHIO

CARDOX *Announces*

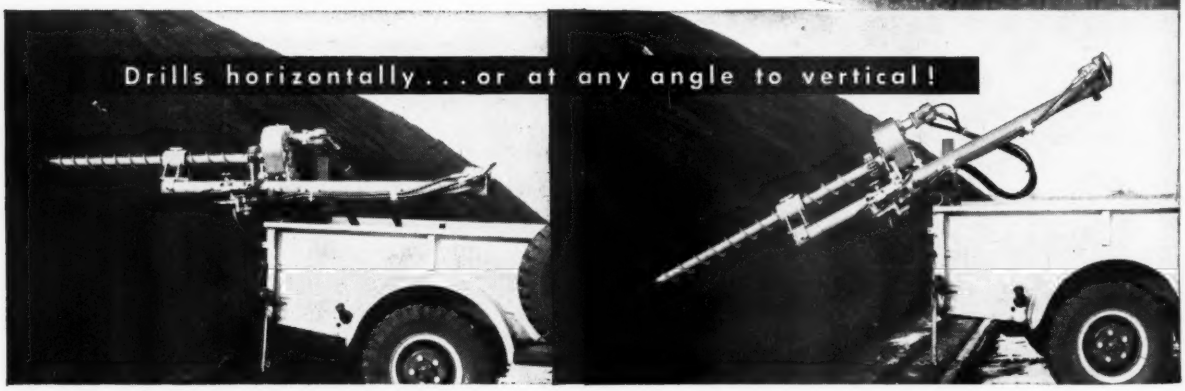
NEW TRUCK-MOUNTABLE* GENERAL PURPOSE drill



- **Hydraulic-powered**
- **Hydraulic-controlled**
- **Auger sizes from 3 to 12 in.**
- **Drills vertically, horizontally or at any angle in between**

Mobility pays off when power, speed and rugged construction are not sacrificed. The CARDOX general purpose drill gives you these features and more. It adds control such as is seldom found outside machine shops. Can drill at any fore-and-aft or lateral angle from horizontal to vertical with equal power and speed.

*Mounts on any flat-bed truck, crawler or farm-type tractor, or any other mobile equipment with a power take-off to drive its hydraulic system. NOTE: *Can also be dismounted for use as a trench drill or horizontal drilling on different levels.* Maximum feed rate: 20 fpm. Write for complete details.



CARDOX CORPORATION • **BELL BUILDING** • **CHICAGO 1, ILLINOIS**

WAREHOUSES

Harper, West Virginia
Phone: Beckley 4812

Benton, Illinois
Phone: Benton 8-3821

St. Clairsville, Ohio
Phone: St. Clairsville 619

Pikeville, Kentucky
Route 2, Box 99
Phone: Robinson Creek 5

Louisville, Colorado
Phone: Boulder
Hillcrest 2-7298

Library, Pennsylvania
Box 427
Phone: Library Colonial 3-6910

Camden-on-Gauley, W. Va.
Phone:
Camden-on-Gauley 2181

Evansville, Indiana
307 Northwest Fifth St.
Phone: Evansville 2-8944

Ottumwa, Iowa
Phone: Ottumwa
Murray 4-6564

MINE COAL the Modern, Economical Way

. . . with Bucyrus-Erie Stripping Shovels

Bucyrus-Erie stripping shovels are helping to hold costs in line wherever there are large-scale coal stripping operations. For example, this 1050-B shovel handles the major share of stripping in an Indiana coal mine.

These full-revolving shovels provide the balanced performance and long working range that mean consistently high output as well as low operating costs. From boom point to crawler treads you will find leadership in stripping shovel design —with such features as exclusive two-section boom, twin dual hoist ropes, powerful effective rope crowd with crowd machinery located on main deck and not on the boom, individual motor drive for each crawler unit, outstanding electrical power and control equipment.

Today, as always, it will pay you to investigate the Bucyrus-Erie line of stripping excavators. Capacities range up to 65 cubic yards. 90L56C

SOUTH MILWAUKEE **BUCYRUS ERIE** WISCONSIN

Expanded Facilities

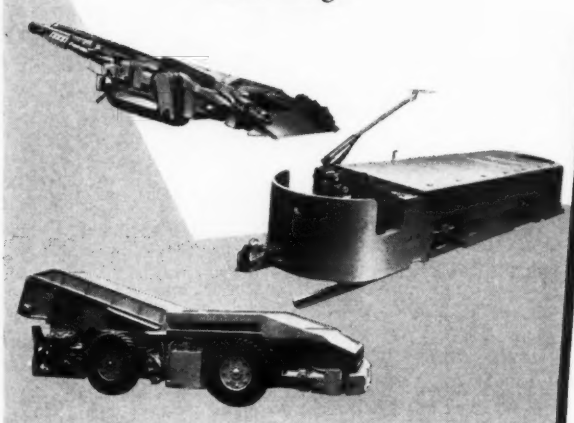
for rebuilding your mining machinery

Completion of this 55' x 250' crane shop addition to our Bluefield, West Virginia, plant for rebuilding mining machinery assures you of complete service.

You can count on National rebuilt equipment for new machine performance at BIG savings

We provide . . .

- Thorough incoming inspection
- Only proper replacement parts
- Modernization by incorporating latest design
- Thorough final testing to assure satisfactory operation
- New equipment guarantee on all rebuilt machinery



THE JEFFREY MANUFACTURING COMPANY
COLUMBUS, OHIO
takes pleasure in announcing an agreement with
National Electric Coil Company
BLUEFIELD, WEST VIRGINIA
as its authorized Agent for rebuilding Mining Machinery of its manufacture.
These additional facilities will assure you of receiving original manufactured Renewal Parts assembled to original Engineering specifications to meet the mandatory standards of new equipment.

NATIONAL ELECTRIC COIL COMPANY
COLUMBUS 16, OHIO, U. S. A.
ELECTRICAL ENGINEERS MAKERS OF ELECTRICAL COILS AND INSULATION—
REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES

PROLONGED CONFINEMENT COUNTS

...when it comes to blasting efficiency

Preparing for "coyote" shot. Tunnel dug 50 ft. into hillside . . . then right-angled 25 ft. off trunk in either direction. Atlas explosives loaded at ends of "T" crossbar. Back filled. Ready to fire electrically.

Prolonged confinement of blast keeps 8250 lbs. of explosives hard at work underground. Little wasted energy. Explosives force disintegrates hillside. Good displacement. Excellent fragmentation.

Huge workable final pile. 75,000 yds. of well-crushed rock . . . broken into small fragments. Here's peak blasting efficiency . . . easy work for the shovel. It's the prolonged confinement that counts!

PROLONGED CONFINEMENT—the Rockmaster® way

How's this for breakage! For explosives efficiency! Here's a blast that really paid off—in good displacement . . . in quick, easy, economical removal.

When it comes to getting the most out of your explosives, it's *prolonged confinement* that counts! In this "coyote" shot, Roseburg Lumber Co., Roseburg, Ore., loaded 7750 lbs. of Atlas Flodyn and 500 lbs. of Atlas 40% Gelatin well inside the hill. Explosives force was confined to the burden . . . instead of blasting the air. The right combination of ROCKMASTER electric blasting caps and Atlas explosives shows—

- **good control**
- **improved breakage**
- **greater efficiency**
- **better public relations**

Before your next blast, why not go over your specific blasting problems with your Atlas representative? He has ideas and experience you can put to use . . . and profit from. And get "Better Blasting"—Atlas' informative newsletter on latest methods and materials. Write us to put your name on our mailing list today.

EXPLOSIVES DEPARTMENT

ATLAS POWDER COMPANY

WILMINGTON 99, DELAWARE

offices in principal cities

TOUGH HEAVY DUTY MINING CABLES *that have no equal!*

New SUPERTUF JACKET* makes SUPER SERVICE MINING CABLES *tougher than tough*

***General Cable's remarkable Flame Resistant SUPERTUF JACKET is a new neoprene compound processed for maximum lasting toughness, high density and tensile strength—*extra smooth* for wear, cut and tear resistance.**

General Cable... *at your service!*

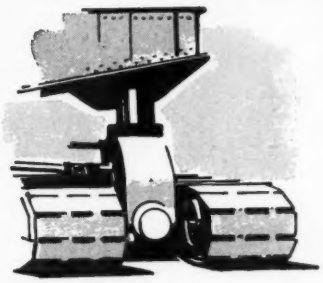
GENERAL CABLE CORPORATION, 420 Lexington Avenue, New York 17, N. Y. Offices and Distribution Centers Coast-to-Coast

How to cut mining maintenance costs

Use STANOIL Industrial Oil— save these three ways

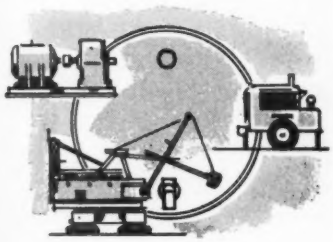
1 Reduce oil inventories

STANOIL Industrial Oil can be used in so many places that you can reduce inventories of special oils. Add to this the economy of simplified storage and handling. Use STANOIL Industrial Oil in electric motors, air compressors, fans, blowers, transmission and clutch lubrication, and hydraulic systems. Use STANOIL to lubricate bearings either in direct application or in oil circulating systems.



2 Get better lubrication

Special solvent-refining techniques plus the blending in of exclusive additives make STANOIL the finest industrial oil. STANOIL resists chemical change . . . lubricates effectively and completely over a wide temperature range . . . cuts wear. It protects oil systems from troubles due to carbon deposits, corrosion and emulsion. It stands up under heavy and repeated shock loads. STANOIL has high oxidation stability and extremely low carbon forming tendency.



3 Prevent application mistakes

When there is only one lubricant, there can't be any chance of the wrong one being used. With STANOIL, errors in application that would result in breakdowns are eliminated; equipment stays in service longer; maintenance is easier; overhauls go more smoothly and equipment is back in service faster.

Get more information about STANOIL Industrial Oil. Call your Standard Oil industrial lubrication specialist. He is experienced in mine lubrication. There is one near you in any of the 15 Midwest and Rocky Mountain states. Or write, Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

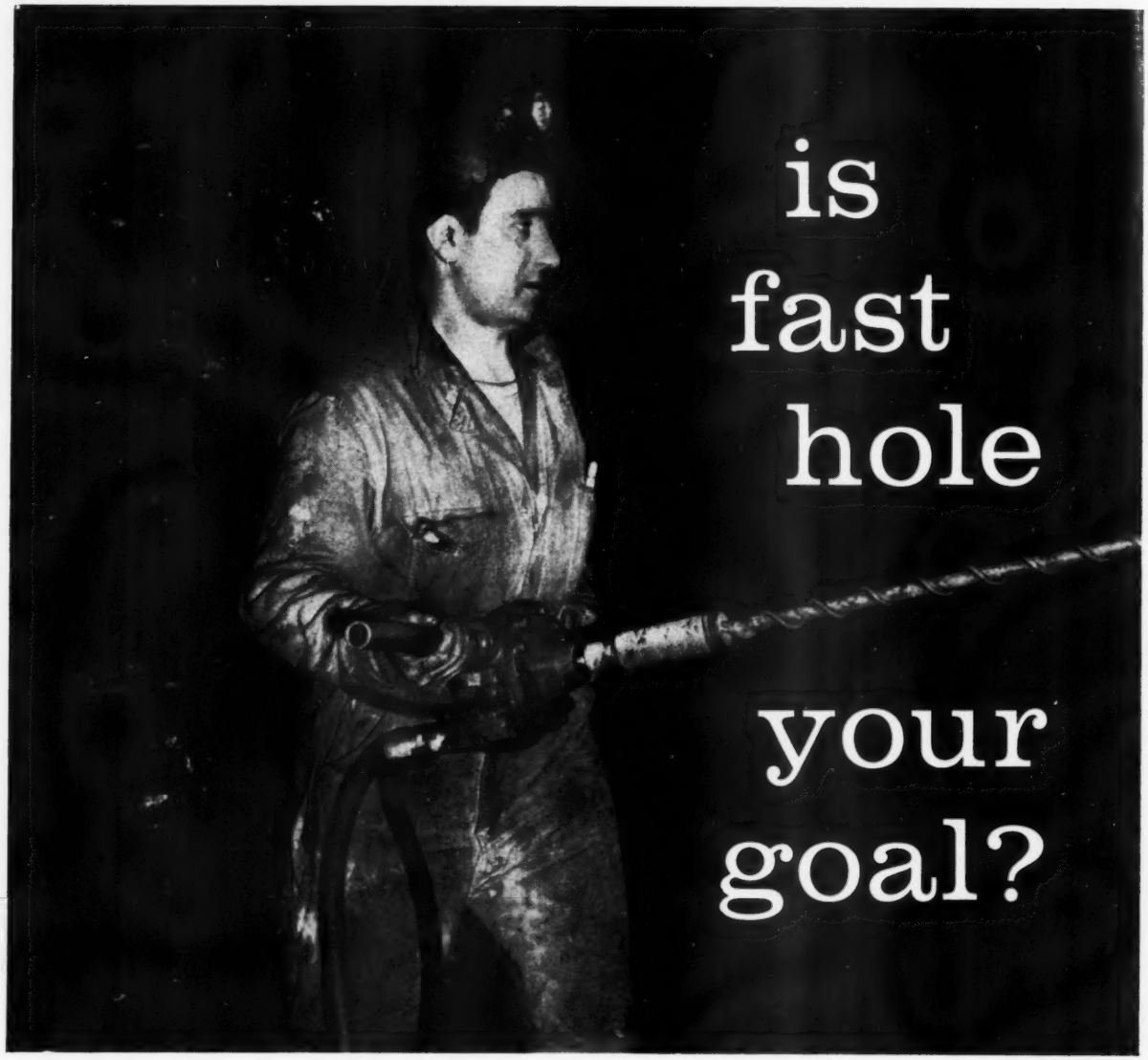
STANDARD

STANDARD OIL COMPANY
(Indiana)

Quick Facts About

STANOIL Industrial Oil

- **Stability**—STANOIL's antioxidant gives oil resistance to chemical change, minimizes deposits.
- **Rust Prevention**—The inhibitor in STANOIL "plates out" on metal surfaces, prevents corrosion.
- **Cold Starts**—STANOIL has low pour point. Flows freely from cold start. No need for costly warm-ups.
- **Resists Effects of Temperature Change**—STANOIL has high viscosity index, resists temperature change.
- **Has Excellent Demulsibility**—STANOIL is refined to eliminate emulsion problems, contains additive to minimize foaming.



Get a CP Hydraulic Coal Drill!

SAFE AND EASY TO HANDLE

- NO SPARKS
- NO SHOCKS
- NO KICK OR STALL

You just can't beat the lightweight CP-35-HCD Hydraulic Coal Drill for fast hole drilling . . . *it drills 9 foot holes every 30 seconds in hard seams!* Its high torque motor delivers the power bonus and has the response needed for hard drilling in tough seams.

And more! The auger runs at optimum speed to minimize vibration and make long lengths of auger easy to hold. The CP-35-HCD can be run from the power system of cutting, timbering or roof bolting machines. A complete line of accessory equipment . . . valves, gauges, junction blocks, hoses and fittings is available. *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.*

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

Allis-Chalmers

model D

THE LOW-COST MOTOR GRADER THAT OFFERS

more of everything...

more PRODUCTION-BOOSTING FEATURES

Choice of Allis-Chalmers engines

GASOLINE — 50 brake hp. Bare grader weight —8,800 lb. Four forward speeds to 25.6 mph, one reverse to 3.3 mph.

DIESEL — 50 brake hp. Bare grader weight — 9,350 lb. Four forward speeds to 25.2 mph, one reverse to 3.2 mph.

ROLL-AWAY moldboard rolls the load instead of pushing it, moves more dirt, uses less power.

Plus one-piece tubular frame, tandem drive, real operator comfort, hydraulic blade lift.

USEFUL OPTIONAL FEATURES

Power circle turn for faster, easier, better control of blade . . . turns 135 degrees.

Leaning front wheels with heavy-duty axle, for better control in close quarter-work.

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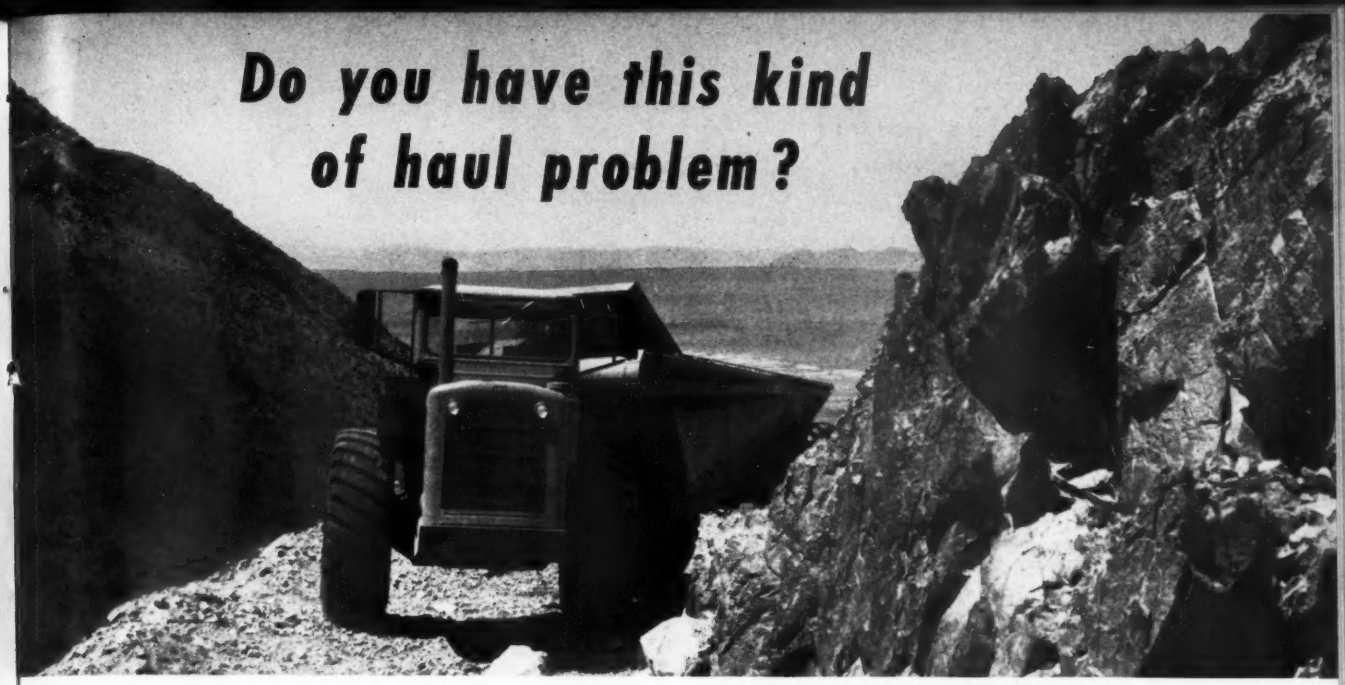

180° switch-backs...narrow, steep, one-way haul roads...tight quarters

The Standard Slag Co., of Youngstown, Ohio are tackling some tough hauling problems at their magnesite ore mine, at Gabbs, Nevada. One mile, one-way haul road is narrow and steep, with sharp 180° switch-backs...loading is on narrow benches, dumping areas have restricted access. Compact, highly maneuverable machines were needed to handle the job ...Standard picked 2 D Tournapull Rear-Dumps for the assignment.

Turns within 12'4" radius

Teamed with a ¾-yard Northwest shovel, the rubber-tired "D's" were opening up a bench for loading when photos were taken. Carrying 11 tons of waste rock, the Rear-Dumps hauled to a narrow 15-ft. wide area where material was dumped over a 100-ft. bank. When full scale mining operations begin, company officials report that the "D's" will haul 500 tons of ore daily to the crushing plant over the winding mile-long road notched into the mountain side.

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Easy to control

"D's" on this job reduce the "hard-work" element by simple fingertip electric controls. Operators have no big steering wheels or manually operated shifts and levers to fight... fatigue is greatly reduced. Operator C. E. Metcalf reports, "These 'D's' are very easy to control. In fact they are easier to operate than trucks." The Superintendent on the job said, "The D Tournapull Rear-Dumps can't be beat on our narrow bench job."

Safer than trucks

You'll find as did the Standard Slag Co., that D Rear-Dumps are safer than any trucks where loading, hauling and dumping areas are limited. Three important reasons why "D's" offer greater safety are:

1. multi-disc air brakes with 2,822 sq. in. of braking surface...more braking surface on a single wheel than most haulers have on all four;

2. positive power steer through geared king-pin which gives 90° turning, and sure safe control at all times;

3. front-wheel drive which keeps power and traction on solid footing well ahead of rear wheels during dumping. These safety features give operators more confidence on steep grades and narrow roads, as well as when dumping loads over high banks.

¾-yard shovel loads "D" with 11 tons of waste rock. 90° turning ability of unit allows quick spotting on narrow shelf...wide target permits faster loading.

With front-wheel drive and powerful 4-wheel brakes, unit backs safely to edge of 100-ft. bank...dumps load clean at touch of switch.

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RESULT:

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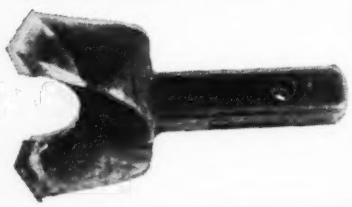

Use of Kennametal D-1⅞" Drill Bits at the No. 12 Alma Mine, Sycamore Coal Company, Mingo County, West Virginia, for drilling their tough Alma Seam, has resulted in the low bit cost of $0.0038 per ton and fast drilling time of one minute for an average 8-foot hole. This is considered very satisfactory in handling Alma Seam conditions of a hard bottom, a 42" bench of bottom coal, a 10"-40" hard slate parting, and a 24" bench of top coal overlaid with 10" of slate and a strong roof. As many as fifteen 8-foot holes have to be drilled and shot in the 30" to 40" range to bring down both the coal and parting for handling. In mining the lower bench, five 8-foot holes are drilled, starting at the center and angled toward the parting.

Whether it is drilling in problem areas or in clean coal, you will find a Kennametal Drill Bit to do the job fast, with low bit and maintenance cost and long bit service. Ask your Kennametal representative to show you these bits. Then try them in your mine. KENNAMETAL INC., Mining Tool Division, Bedford, Pennsylvania.

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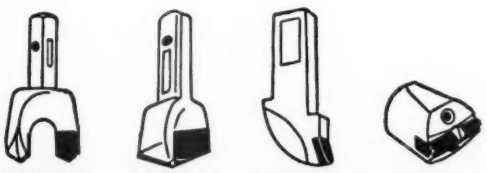

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CONGRESS JOURNAL
Published for the Entire Mining Industry
by the AMERICAN MINING CONGRESS
ROBERT W VAN EVERA, Editor
Volume 42 JUNE, 1954 Number 6

A Look at the Forest—Not the Trees

THE 1956 coal convention is over and the industry is healthier for having exchanged views and technical data on a multitude of subjects. A significant point that came into focus at Cincinnati was the need for executive planning to insure that the coal industry will be able to perpetuate its productive capacity through the development of new operations.

G. A. Shoemaker, Executive Vice-President of Pittsburgh Consolidation Coal Co., made the statement, "Our present scale of coal production represents just about the maximum capacity of our present mines and transportation systems, which means that future increases must come from new facilities or revitalized facilities, and the job of providing these facilities is probably compounded by the fact that perhaps a third of our present mines will be depleted over the next ten to twelve years." Later in his address he said, "The capital cost of our new mines in terms of cost per ton of annual production will probably be double to triple that of our existing properties." Raymond E. Salvati, talking in the same vein, pointed out that the funds allowed through depreciation of today's facilities fall far below those which will be required to replace them.

The head of a major steel company recently observed that "as a result of postwar inflation, it is possible for a company to earn what appears to be a most substantial profit and still wither away and die because this profit was not large enough to pay for the replacement of plants and facilities as fast as they wear out."

The income tax laws do not permit deductions for depreciation in excess of the actual investment in plants and equipment. There is widespread sentiment, and much to be said, for a revised system of depreciation allowances which would recognize the present situation. Meanwhile there is a growing realization that, because of the inadequacy of statutory depreciation allowances, large additional amounts may need to be set aside from earnings and earmarked for replacement, modernization, and needed expansion of productive facilities. Certainly, profit reports to stockholders present a more realistic picture when appropriate reserves are set aside for this purpose.

Labor, stockholders, suppliers and customers, and the public—all should be aware of this situation and should recognize that apparent high earnings may, to a large extent, not be available for higher wages, dividends, etc., but may need to be kept in the business merely to maintain intact—let alone enlarge—the base from which their own income is derived.

Whose Profits?

WITH the general elections less than five months away we are naturally subjected to political arguments on issues of all kinds. All too often the political reasoning appeals to one faction of society as distinguished from another. We are told, for instance, that certain groups are reaping too much of the fruit of our economy—that business is enjoying too much privilege. This "privilege," apparently, is the ability to earn a good profit.

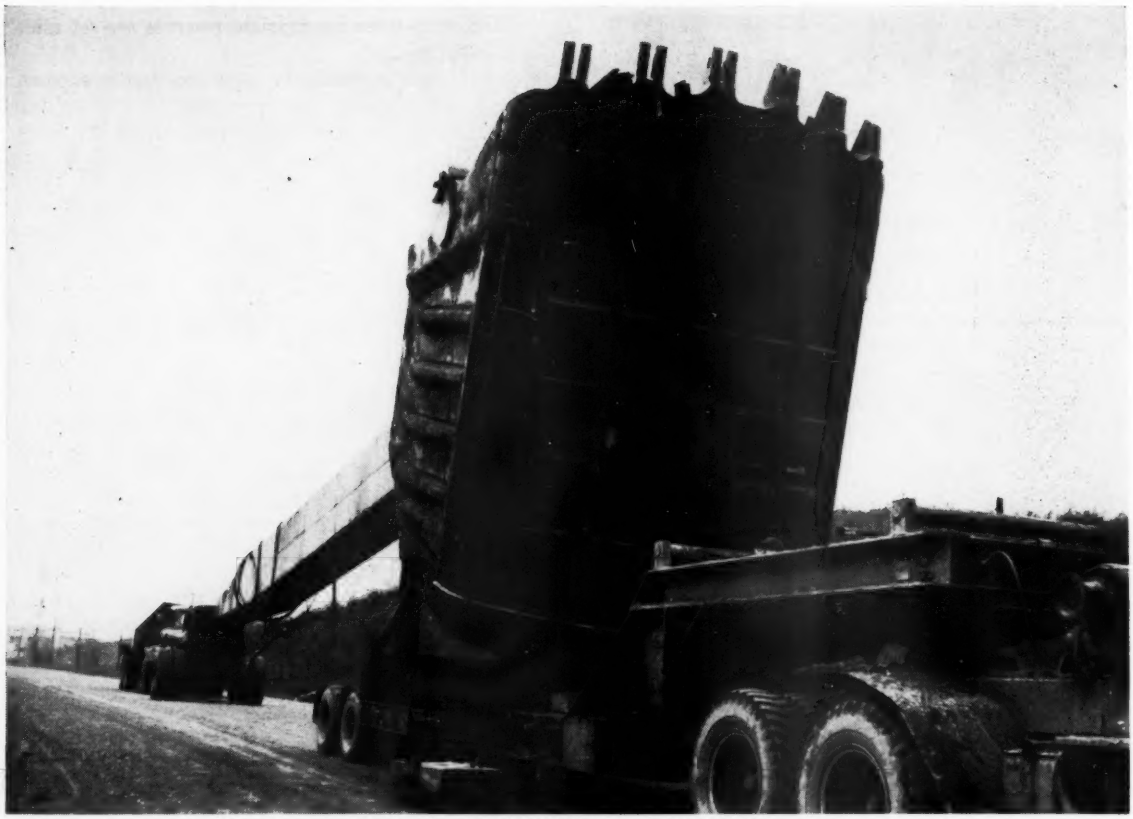
But who actually benefits from business earnings? Roger M. Blough, board chairman of the U. S. Steel Corporation, discussed this in a recent address and pointed out that the principal beneficiary of corporate profits is unquestionably the working man. These profits safeguard his livelihood, provide the "mechanical slaves" that give him the highest standard of living yet known and allow him to produce more in eight hours than his grandfather produced in sixteen with his wife and children helping him.

This "working man" concept was easier to define 40 to 50 years ago than it is today. In that era the working man was usually a common laborer. In a modern business organization he is truly part of an integrated team composed of "working men" at all levels up to, and including, the directors. Working men today *may* be laborers, but they have more opportunity than ever before to be supervisors, skilled specialists, technicians or administrators—when their aptitudes and, more important, their sincere desires qualify them.

Many have neither the desire nor the aptitude to become administrators or businessmen but they need no longer consider themselves "common laborers." They are men who are selling a service and can do so in dignity—taking well earned pride in any job well done. Further, they can look forward to seeing their children fill the elevated positions for which they may not have been qualified.

Persistent rabble-rousers have convinced many people that corporate profits somehow constitute inordinate luxury to be lavished on a choice few owners or business leaders. This is poppycock. Actually they are the price required to attract the necessary capital for more tools—which in turn render greater return to the working man and the nation.

Why then, are we told that business has too much privilege? As the working man has the major share in business profit, so would he lose the most in its curtailment.



Transporting the 60-yd dipper to construction site

The 60-yd Shovel

Engineering development and economics of the machine that is increasing Hanna's coal reserves

By JAMES HYSLOP
Hanna Coal Co., Division of Pittsburgh Consolidation Coal Co.

STRIP mining accounts for 23 percent of the bituminous coal output of the United States. Three factors tend to promote the development of strip mining wherever reserves of strippable coal exist:

1. The production cost of strip mining is on the average substantially lower than underground mining.

2. Strip mining has a very great advantage from a conservation standpoint since practically 100 percent of the coal can be extracted as compared to a much lower figure for underground mining.

3. The accident rate in strip mining is very much lower than underground mining.

On the other hand the development of coal stripping is limited by a number of important factors:

1. There is the very pronounced limitation of the reserves of strippable coal. It is believed that most of the coal which at the present time is regarded as strippable with existing equipment, lying East of the Mississippi River, will be exhausted in less than 50 years.

2. Inasmuch as an operator must purchase surface rights as well as coal rights, the depletion charge is relatively high on strip coal. Furthermore, this fact necessitates, in many instances, the expenditure of large capital sums for coal lands in order to provide sufficient reserves to justify the purchase of large expensive stripping units.

3. In some instances the quality of coal near the outcrop is lower than the coal under overburden of a thickness necessitating underground mining. It will be noted that in recent years this latter consideration is, in many instances, being offset by the tendency to locate power plants within easy trucking or water transportation distance of lower quality coal reserves. The advent of ultra high voltage transmission lines in recent years is a development of tremendous importance to the coal industry, and is resulting in a reorientation of the economic importance of many coal fields.

Range of Present Equipment

Coal reserves available to most strip mines is limited in most instances by the range of the stripping equipment available. Obviously stripping cannot be economical beyond the point where production costs reach the level of underground mining. These are the factors that have given impetus to the effort to build stripping equipment of higher efficiency and greater range. It is difficult to generalize here but it can properly be said that in most instances whenever the stripping ratio

exceeds 20 cu yd of overburden to one ton of coal, the production cost is approaching the prohibitive range. If equipment can be designed which will at once materially decrease the cost of moving overburden and make it possible to strip thicker overburden, such equipment will fill a basic need in the stripping industry.

While a few exceptions can be cited, it is generally true that the range of the largest shovels and draglines built heretofore is limited to about 60 ft of overburden in level topography and this figure can be increased to about 80 ft in contour stripping by taking advantage of outside curves. A number of solutions to the problem of range and yardage capacity are being applied. The more important of which may be listed as follows:

1. Draglines with very long booms have been built in order to increase range, and various schemes of operation have been used in applying these draglines to thick overburden. The dragline has the inherent advantage for this type of work in the fact that the boom is used for transportation only—all of the digging forces are transmitted directly to the revolving deck of the machine by the drag rope. The disadvantages in long range draglines lie first of all in the limited digging ability of the dragline bucket. This factor is particularly important where hard rock is present in the overburden. Furthermore, all large draglines are built as walkers. The problems in tub design and walking mechanism design tend to increase greatly as the size increases. Notwithstanding these handicaps it is entirely conceivable that larger draglines can be built successfully.

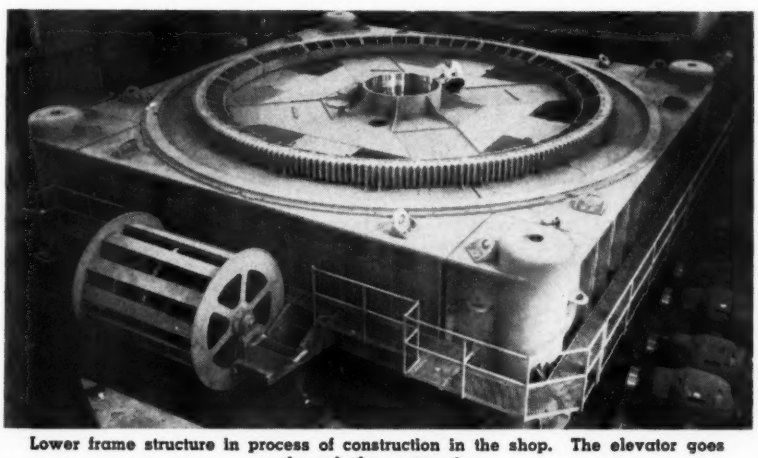
2. Important work has been done in the development of digging wheel and belt conveyor machines. Extremely large machines of this type have been built in Germany and are being used quite successfully. Unfortunately the application of such machines is limited to relatively soft overburden. They do point the way toward the possibiltiy of achieving overburden transportation by the use of belt conveyors.

3. The rehandling of overburden material by machines on the spoil pile has been quite successfully applied, in some instances, and certainly this approach to the problem affords very interesting possibilities. Rehandling, however, inevitably results in a serious increase in stripping costs, and this would seem to be the limiting factor in the application of this idea.

4. Other systems of relatively minor importance have been applied to stripping operations. Examples are the use of carryall type equipment, bridge or boom shuttle car machines and to some extent truck transportation of overburden. However, it would seem that the application of any of these ideas is extremely limited.

The stripping operations of Hanna Coal Co. are located in southeastern Ohio. The coals outcrop on the hillsides and contour stripping is carried on up to the range limitations of available stripping equipment. This means that with 50-cu yd dippers on our Marion 5561 shovels we have been able to strip to a maximum overburden thickness of 80 ft and to an average maximum highwall of 70 ft above the top of the coal. The overburden ratio at 80 ft of cover is about 19 to 1, and production costs under these maximum conditions are still below underground costs in the same area.

Coal reserves available to most strip mines are limited in most instances by the range of the stripping equipment available



Lower frame structure in process of construction in the shop. The elevator goes through the center pin

About the Author

James Hyslop's name is synonymous with strip mining and advances in strip mine technology. He has led in the work of increasing shovel capacity through the use of alloy steels and The Mountaineer stands as a tribute to his efforts.

Born in Scotland, Mr. Hyslop received his early coal mining experience in Indiana. In 1940 he left a job as manager of operations for Walter Bledsoe & Co. to become general manager for Hanna Coal Co. in eastern Ohio. He was made president of Hanna in 1950.

The overburden material consists of hard shale, hard limestone and, in some cases, hard sandstone. With the 50-yd shovels we are able to average 1,200,000 cu yds of overburden per month.

Need for Larger Machine

For several years we have been studying the possibility of applying larger machines to our work. Additional reserves of coal lie at hand under the heavier overburden. For the most part we own this coal and it is available at very low depletion charges. When the limitations of the total strip reserves are considered, the desirability of machinery capable of stripping heavier overburden is apparent.

In studying the possibilities of the success of larger machines a number of important assumptions and questions asserted themselves, such as the following:

1. The rocky character of our overburden seemed to us to indicate the superiority of shovel equipment for our work.

2. Since the overburden is rock practically all the way to the surface, any machine used must be capable of digging to the top of the overburden. Our experience in rocky overburden indicates that the problem of filling a large dipper is not simple—it is obvious that there must be a maximum practical dipper size.

3. Since the weight of the revolving elements of a machine will have to be increased, and since there are practical limitations on the amount of power that can be applied to the swing motion, the question arises, how big can a shovel be built without necessitating an increase in the swing time factor of the operating cycle?

4. The capital cost of the stripping unit is vital in the over-all economics. therefore, the relation of the capital cost to the yardage capacity is of primary importance.

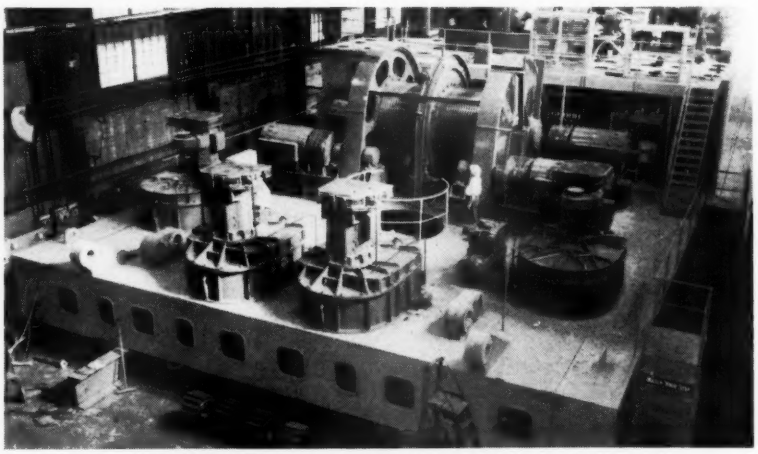
Cooperative Project

The only way to get even tentative answers to some of these questions was to design a machine which would be capable of doing the work required and which would have its dimensions determined by the best analysis which could be made of the experience of ourselves and other operators. With this idea in mind Hanna Coal Co. and the Marion Power Shovel Co. entered into a cooperative project to explore the possibilities of designing and building a bigger stripping shovel than had ever been built in the past.

Utilized Past Experience

In the use of our Marion 5561 machines and a Bucyrus 550 shovel, we had made important progress in analyzing and overcoming some of the inherent limitations and defects of conventional equipment and we, of course, determined to apply all of the progress we had made in this direction to the design of what we began to call the super shovel. Mention of some of these items would seem warranted here:

1. We had made important progress in the application of high-strength alloy steels to our stripping equipment. By the application of heat treated alloys and the use of weldments instead of riveted or bolted construction, we had succedeed in increasing dipper capacity on our big machines from 35 to 50 cu yd and on the 550 shovel from 17 to 24 cu yd. We, therefore, determined to apply all of the valuable experience we had gained in these developments in the new design.



A view of the upper frame during process of erection

2. We had become convinced that conventional machines were designed with inadequate horsepower on practically all motions and that the electrical control characteristics in use could be greatly improved. One of the primary conclusions we had reached was that the bail pull characteristics could be ameliorated. It is customary to measure bail pull in terms of performance under stall conditions, and all machines are designed with motor sizes and control characteristics which permit this bail pull to fall off very rapidly as the speed increases. We believe that the ideal arrangement would be to design a hoist which would maintain the maximum bail pull right up to maximum speed. The implications of this theory are obvious. A very material increase in motor and generator size would be required and a radically different approach to the control problem would have to be made in order to approach the flat torque curve characteristics required.

3. The capacity of all shovels is limited by the load carrying ability of the roller bearing on which the machine revolves. Furthermore, one of the most bothersome items of maintenance in shovel and dragline operations is the wear and tear on the roller circle assembly. It has been customary in the past to build up the necessary strength in the deck under the roller circle by the use of laminated deck plates. This, together with the type of construction used throughout the stationary and revolving frames resulted in a roller circle with a very considerable lack of rigidity, and which was subject to a great deal of flexure during the operation of the machine. It was decided that the laminated deck plates should be replaced with much heavier solid plates and that these plates should be rigidly and adequately supported by welded frame construction. It was further resolved that the performance of the roller circle would be greatly improved if the deck plates could be completely machined after being welded and thus afford a roller bearing which would have a machined surface accuracy and which would be supported with sufficient rigidity to maintain alignment.

4. One of the most important influences on the productivity of any machine is its performance with respect to mechanical and electrical breakdowns. It was, therefore, decided that every effort would be made to improve the durability of the new machine by eliminating, so far as possible, all sources of chronic breakdowns and by increasing the life of all expandable items, and a number of important improvements in this category are incorporated in the new machine.

Component Life

One of the most bothersome repair problems is that of replacing worn digging elements. For several years we have been using heat treated alloy steel dipper teeth, and tooth bases. We had developed these items with features which practically eliminated failure of the tooth fastening wedge

by providing accurately machined fits between the base and the teeth, and between the engagement surfaces and the wedge pin. These same features were, of course, incorporated in the design of the new machine. Abrasion resisting wearing plates and hard surface weld metal were applied generously to the dipper itself.

Rope life is another item that has a significant influence on output. Our studies of this problem had shown that the small sheave diameters and drum diameters necessary on these machines had been receiving too much blame for short rope life. We found that rope life could be materially increased by proper lubrication and that it was possible to increase rope life from two to three times without increasing sheave or drum diameter. In the design of the new machine we provided for careful rope lubrication and elected to take advantage of what we had learned about sheave size by keeping the sheave diameters to a minimum. The Mountaineer shovel is equipped with 2½-in. hoist ropes. The boom point sheaves have a diameter of 90 in. and the padlock sheaves 68½ in. The boom point sheaves were designed on a swivel arrangement which permits the sheave axis to adjust itself to the swing of the dipper. The machine was designed with a double two-part hoist rope arrangement. While our experience to date is limited, it definitely indicates that satisfactory rope life is going to be experienced in this unit.

The rack and pinion method of applying the crowd force was utilized

In designing the crawlers, great care was exercised to provide extreme ruggedness and durability. Alloy steel machine cut gears were used throughout, and it is already quite obvious that these crawlers are going to give an excellent account of themselves.

The rack and pinion method of applying the crowd force was decided upon and an effort was made to materially improve the durability of the crowd handle by the use of machine cut gearing and a new design of the crowd machinery which would greatly reduce the maintenance in this area. Here again our experience to date indicates that these improvements are highly successful.

Examples given are representative of the care that was exercised in designing the mechanical and electrical equipment throughout this shovel and it is hoped and expected that the maintenance cost will be very much improved over that of older machines and that a corresponding increase in output will be achieved.

Electrical Design

In approaching the electrical design, it was seen that consideration would have to be given to increasing the voltage of the power supply. The conventional 4160 v supply was obviously impractical as the size of the trailing cable would become highly objectionable and the heavy power demand would seriously limit the allowable distance between the shovel and the transformer substation. After considerable study, it was decided to adopt a 7200 v power supply system.

Magnitude of the power supply problem can be appreciated by reference to the fact that the synchronous motors driving the main generator, the swing generator and the exciter total 4650 hp. The total connected ac hp is approximately 6000.

Reference to the table of specifications comparing the 5760 machine with the 5561 design indicates the significant increase in the maximum speed of the hoist and crowd motions. The greatest difference in this respect is in the lowering speed of the hoist. This increased speed eliminates the handicap of having to wait on the lowering of the dipper after the machine has been swung into digging position. A significant improvement in average cycle time has been effected by the increase in lowering speed.

The General Electric Co. succeeded in accomplishing the improvements in control by the application of their Amplidyne system. An interesting feature of the development of the control design lies in the fact that after the control objectives had been established and the motors and control characteristics fitted to these specifications, the whole arrangement was set up on the GE Company's electronic analog computer. The tests on the computing machine indicated that the desired performance could be achieved and the operating results to date indicate that the electronic brain is much better adapted to analyzing engineering problems than it is to accurately foretelling the results of election returns.

Performance to Date

This machine began digging about February 1, 1956. Its performance since that time has, of course, been limited by many factors attendant upon putting any new machine through the shake-down period. So far, there has been no opportunity to actually test the yardage capacity of the machine but its performance indicates that it will more than meet the performance estimates upon which its purchase was predicated. It would seem significant that during the month of February the "Mountaineer" moved 1,080,000 cu yd. This was done under highly adverse operating conditions as it operated in an old pit that was very narrow, having a highwall of 80 ft. During this period, the machine operated on a footing of freshly placed spoil 20 ft above the top of the coal and the actual operating time for the month was about 67 percent, the lost time being accounted for by adjustments, deadheading and pit clean-up operations.

Ability of the machine to operate on the spoil has been most gratifying, being distinctly superior to that of the older units. The crawlers performed admirably and demonstrated the feasibility of operating on a very uneven terrain and on loose and unconsolidated rock and shale.

Performance of the 60-yd dipper has been more than satisfactory. We are now sure that it is feasible to operate a dipper of this size and that it can be filled consistently if adequate power is applied and if the geometry of the digging elements is correct. We have, of course, not settled the question as to what the maximum practical dipper size would be but I feel confident that a dipper of 70-cu yd capacity could also be made to perform satisfactorily if it were attached to a machine of proper design, and applied to overburden of sufficient thickness.

The soundness of our theories with respect to horsepower and control have also been clearly demonstrated. This machine can and is utilizing the horsepower built into it. The tremendous merit of the flat torque curve

TABLE I

	5561	5760
Dipper Capacity	50 cu yd	60 cu yd
Boom Length	120 ft	150 ft
Weight	3,500,000 lb	5,500,000 lb
Height of Boom Point	121 ft	147 ft
Height of Crawlers	6 ft-4 in.	8 ft
Length of Crawlers	19 ft each	23 ft each
Maximum Dumping Height	81 ft-6 in.	97 ft
Maximum Dumping Radius	120 ft	145 ft
Total Rating of Main A.C. Motors	1500 hp	4650 hp
Power Supply Voltage	4160 v	7200 v
Peak Power Demand	2500 kw	6840 kw
Lowering Speed	340 fpm	948 fpm

characteristics of the controls has been proven. A few minutes observation of the remarkable ability of the machine to fill the dipper very quickly indicates the superiority of the control system and the increased horsepower.

Another outstanding feature of the operation of the machine lies in the obvious superiority of the roller circle and its support over previous designs. The circle rails are bolted rigidly to the decks and their fit on the machined surfaces is so secure that there is no noticeable movement or deflection during operation.

Automatic Elevator

One of the interesting design features is that the conventional type of center pin has been replaced by a large tube having an inside diameter of five ft. Two reasons prompted this design: First, the advantages of the large bearing and the secure rigidity was obvious; second, it was decided to install an automatic passenger elevator which would operate through this hollow center pin. This elevator greatly reduces the very real hazards involved in people getting on and off the machine while it is operating. The elevator revolves with the revolving frame and it can be stopped at either of two levels of this frame, as well as at the ground level. We are highly satisfied with the advantages realized from the installation of the elevator unit.

Improved Revolving Gear

Operation of the improved revolving gear has also proven to be highly satisfactory. The machine is equipped with four swing drive units, each having a horsepower of 187.5. In this way, the severe acceleration and deceleration loads of the swing motion is distributed to four points on the circle gear by the four driving pinions. The circle gear itself is a new design, being of very heavy construction, and being very securely bolted to the heavy deck plate. The teeth are flame-cut and this, together with the general design and the accuracy of machined surfaces, resulted in a much more accurately fitted gear and pinion assembly. The quietness of operation and complete lack of any evidence of wear or strain attests to the success of this design.

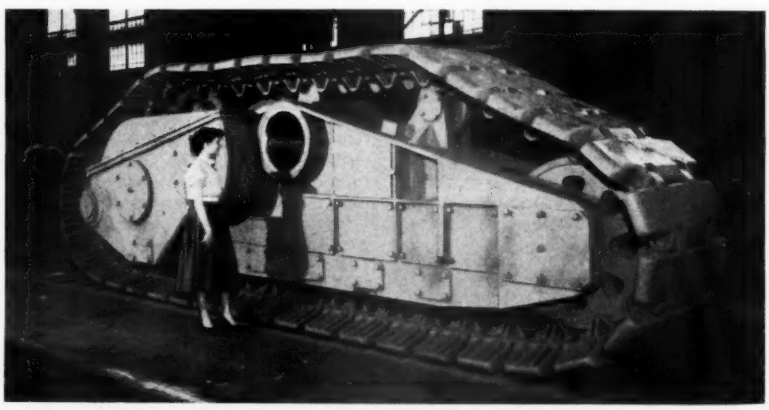
Specification of the 5760

A decision was made to build a machine having the specifications of the "Mountaineer" after having made layouts of a machine considerably larger. At one time we contemplated a unit that would have had a working weight of over 7,000,000 lbs. This design would have been just about twice the size of the largest existing machines. We were dissuaded from proceeding with a machine of this size by economic calculations rather than by any serious misgivings about the physical ability of the machine to successfully execute the work contemplated. This unit would have cost between $4,000,000 and $5,000,000 and we decided that while it was by no means clear that such an expenditure for such a machine would be prohibitive, the risks involved in going from a 3,500,000 lb machine to a 7,000,000 lb machine in a single step were such as to indicate that it would be prudent to compromise by designing a unit somewhat smaller. The new Marion 5760 is the result of that decision. This machine, as it stands today, is equipped with 150-ft boom and a 60-cu yd all-welded dipper. Table I indicates the comparative specifications of the 5561 and the 5760.

Our limited experience with the operation of the "Mountaineer" to date does not provide an adequate basis for a final appraisal of the economics of its operation under our operating conditions, but we feel assured that the machine will more than fulfill the performance estimates. We calculated that the average monthly performance would be not less than 1,450,000 cu yd as compared to the output of our 5561 units which average about 1,200,000 yd per month. This simple comparison, however, does not provide a very accurate gauge of performance since the Mountaineer shovel will operate in plus 70-ft cover territory exclusively, whereas, our present machines operate under the more favorable conditions of lower overburden. My own observations of the performance of the 5760 to date lead me to believe that under comparable conditions, its output will exceed that of the 50-yd units by more than 50 percent. We feel assured that the performance of the machine will more than justify its cost of approximately $2,600,000.

Shake-Down Successful

Perhaps the most significant feature of our experience to date lies in the fact that no serious breakdowns have occurred and there have been no indications of design defects in any category. The performance has altogether been highly gratifying. The shake-down period has been characterized by an almost complete absence of the type of failures and delays which would be considered normal in putting into operation a highly complicated mechanism of an almost completely new design. We believe that the degree of success that has been achieved in the initial operation of a prototype unit is an eloquent commentary on the merit that lies in an approach to the design of mining equipment which proceeds on the principle of the closest and fullest cooperation between manufacturer and operator. Our industry could do with a great deal more of this type of thinking and action than it has displayed in the past.



The eight-ft high, 60-ton crawlers were designed to provide extreme ruggedness and durability

This photograph was taken in 1891, two years after the Hercules claim was staked by Harry Day and Fred Harper

Geology of the Hercules Mine

With a Well Planned Exploration Program and Assistance from the Defense Minerals Exploration Administration, The Day Mines, Inc. Reopened an Abandoned Mine and Discovered New Ore

By GARTH M. CROSBY
Chief Geologist
Day Mines, Inc.

THE Hercules Mine is located in the northeastern part of the Coeur d'Alene Mining District, about two miles north of Burke, Idaho. The two original claims were staked by Harry L. Day and Fred Harper on August 24, 1889, and ore production commenced in 1902. Incomplete records show that from 1912 to 1925 the mine produced about 2,500,000 tons of silver-lead ore averaging 7.7 oz of silver per ton, 9.4 percent lead, an estimated two percent zinc, 0.3 percent copper and 20 percent iron. Altogether, over $20,000,000 in dividends were paid from ores and concentrates with a gross value of about $80,000,000, based on a five-cent lead price. Early mining operations were in Gorge Gulch north of Burke at the portals of the No. 1, 2, 3, and 4 adits. In 1913 the gravity mill and sorting plant near the portal of the No. 4 adit were destroyed by fire, and a new plant with a capacity of 1200 tons per day, which included a flotation section was built near the west city limits of Wallace. Ore was shipped to it by rail from a new sorting plant built in Burke.

The lowest adit, No. 5, with portal in Burke, reached the vein at about 8200 ft on May 1, 1914, and all subsequent operations have been conducted through it. A four compartment shaft was sunk below the No. 5 adit to the 1200 level. As mining reached the lower levels relatively higher percentages of iron predominated in the vein. As the lead mineralization became impoverished, there was a corresponding increase in iron bearing gangue minerals. The deepest stopes in the mine were above the 1000 level, and the deepest level, 1200, showed no commercial ore. A diamond drill intersected the vein 300 ft below the 1200 level but offered no encouragement and operations were suspended in April 1925, after all the known ore had been extracted. The mine was allowed to fill with water to the collar of the shaft at the No. 5 adit. During this time an ore body 3250 ft in height and an average of 500 ft in length had been mined.

Reopening of Mine

The Hercules Mining Co., and 11 other companies, were merged into Day Mines, Inc., in October 1947, and this new company undertook the unwatering and rehabilitation of the shaft workings during the same year. Faith in the geological setting of the persistent vein structure encouraged

reopening at a time when metal prices were improved. Unwatering was accomplished by bailing, using two 1200 gal bailers borrowed from the Hecla Mining Co. operated in counter-balance by the flat-rope Nordberg hoist installed in 1917. Details of this unusual operation are recorded by Henry L. Day, president of Day Mines, Inc., in the MINING CONGRESS JOURNAL for June 1948. The shaft was found to be in usable condition and some of the levels required but little work to reclaim them for mining purposes. A few small blocks of ore were found near old stopes by diamond drilling the walls of the 800 and 1000 levels. Mining in this area, chiefly near the shaft, consumed most of the first year following reclamation.

In July 1949, the west face of the 1000 level was entered and the drift extended under the 800 level where scattered ore occurrence had been found earlier. In this area the first new ore was discovered. From the encouragement gained on the 1000 level, and a subsequent 1300 winze level, it was decided to sink the main shaft to the 1600 level and to drift about 2800 ft west to test the vein at a deeper horizon. Defense Minerals Exploration Administration assisted Day Mines, Inc., in the venture which was virtually completed last summer. Current plans include sinking a vertical winze at the west end of the mine to reach the 1900 level.

Hercules Anticline

From a regional geological viewpoint the Hercules structure cuts across a broad north-south striking anticlinorium lying to the east of a moderate-sized monzonite stock. Two thousand ft east of the mine is the O'Neil Gulch overthrust fault with a displacement of about 2000 ft. Rocks found in the mine belong to the lower section of the pre-Cambrian Belt Series, namely the Prichard argillite and the Burke quartzite, and are folded into a tight syncline with a rather flat trough. A large part of the mine below the No. 5 adit west of the shaft exposes flat Prichard rocks. To the east of the deposit and well exposed in the crosscuts of No. 3, 4, and 5 adits is the corresponding anticline similar in character to the syncline but displaying a sharp crest. This structure has been named the Hercules anticline.

Wall rock alteration is practically lacking in this mine as compared to many other deposits in the district. Where alteration does occur it is confined near the vein and might be considered a part of the vein mineralization. Hardening of the rock seems to be the result rather than softening as is common in the case of bleaching. Silicification and, to a much less degree, garnetization are apparently involved in the hardening processes.

The fracture along which the Hercules ore body has been deposited is a very interesting one. As in many deposits in the Coeur d'Alene District, the ore bearing fracture effected little displacement. The Burke-Prichard contact is thought to be near the shaft at the No. 5 adit where it strikes N 20° E and dips west about 45°. The average strike of the vein across the main part of the mine is N 70° W, and the average dip is 75° S. At the ends of the vein the strike swings gradually toward the left as one faces the respective directions. This produces an open "S" when viewed in plan. The changes in strike are better viewed in composite plan since the east end of the structure is exposed only in the upper levels, on and above No. 5 adit, and the west end is exposed only in the lower levels, the 1000 and 1600.

Rambler Vein

A unique knot of the Hercules vein occurs in the far west end of the mine, and was first found on the 1000 level. As the drift was being advanced into virgin ground a conformable and smoothly rounded end to the vein was suddenly encountered. Banding, which is often very obscure, indicated the vein had turned toward the right about 120°. Test holes verified this deduction and indicated also that there was no mineralization in extension of the drift. Additional drifting and diamond drilling finally disclosed the vein, which was followed through two more sharp turns. Map-

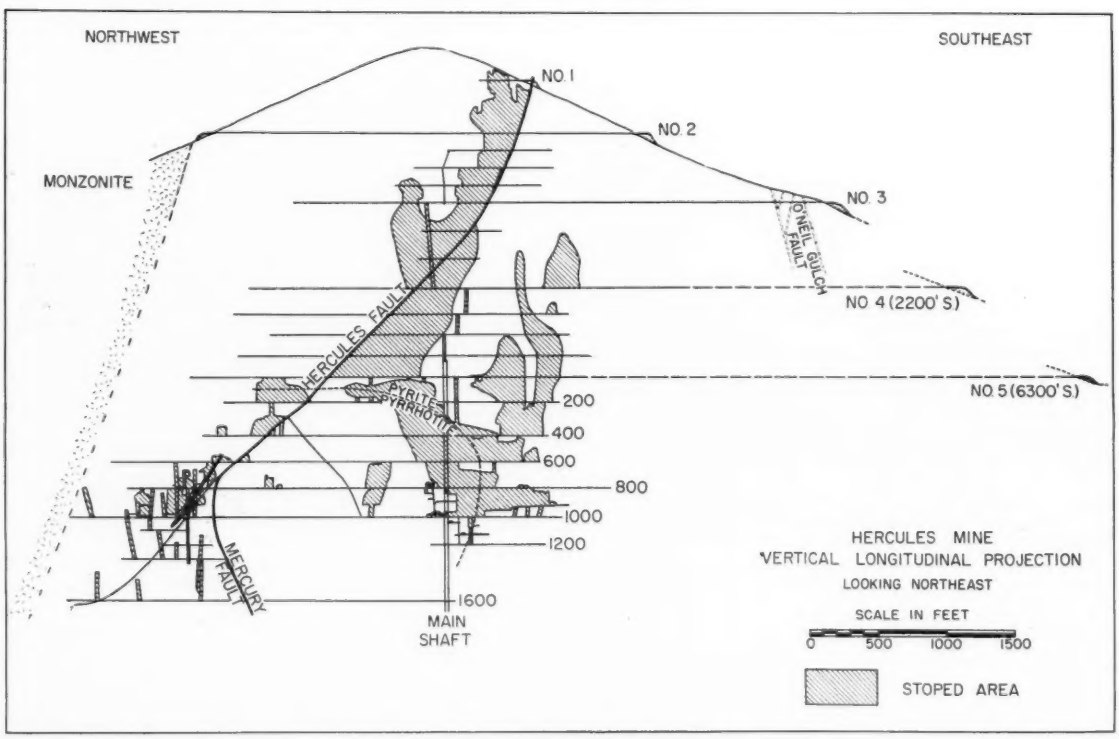


Fig. 1—Longitudinal section of the Hercules mine

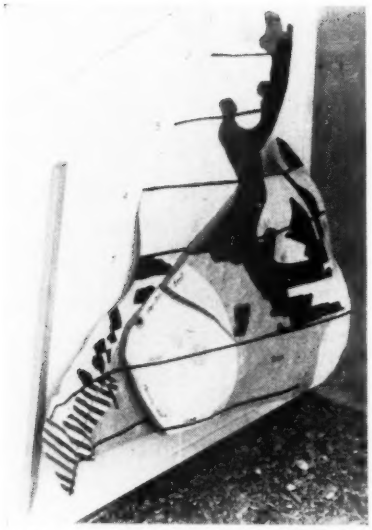


Fig. 2—An oblique view of the paper mache model of the Hercules vein looking northeast

ping shows the vein coursing through three double-hooks or "knots," in which the vein turns at least 90° to the right and in a short distance turns back to the left along the former strike. It was felt that the vein in this area needed a separate name. Miners had referred to it as "rambling," and coincidentally, the vein lies under the Rambler claim—so the name "Rambler" was adopted. On the 1600 level the knot is the shape of an ellipsoid containing a jumble of vein material with main trunk veins leading through it. In explaining this knot, one might assume the proximity of the monzonite stock and the forces accompanying it could be held responsible. However, the altered Prichard rocks in this area do not show similar distortion, and, furthermore, the mineralization is later than the monzonite. There is the suggestion of a similar occurrence in the old Success Mine which is in a similar geological setting. The lack of detailed records leaves the question unanswered and apparently we must depend on data from future openings in the Hercules to unravel the tangle of evidence.

Barren portions of the vein fracture show fairly sharp walls confining a few inches to several feet of crushed rock, shears and gouge seams. Characteristic footwall shearing, one to 12 in. in width, is found in most places. In some places it has either been absorbed by the vein mineralization or was never particularly well developed. Strong-appearing gouge and shearing curiously dissipate along the strike into weak-appearing gougy seams and crushed rock, or perhaps crushed rock alone. This weakening supports the conclusion that the structure has little offset along it. Old stopes between the 1000 and 800 levels show a strong development of flat, east dipping striations, or grooves in the hanging wall indicating the south block or hanging wall has moved east and that vertical movement has been normal and less than horizontal movement. The gash fracture pattern suggests the same type of displacement.

Strong Cross Fault

The Hercules vein is cut by a strong cross fault known as the Hercules fault (not to be confused with the ore-bearing fracture) striking about N 40° E, and dipping west an average of about 45°. It is recognized through all the levels of the mine with offsets up to 200 ft (Figure 1). The fault is composed of up to 12 in. of tight shearing and gouge. The fault forms the east boundary of stoping in the highest levels of the mine, cuts diagonally across the stopes between No. 3 and 4 adits, and forms the west boundary of stopes below to the No. 5 adit below which it cuts barren vein fracture. The fault produces lefthand offset above the No. 4 adit, displays no offset at the level and produces right-hand offset below the No. 4 adit. Acid dike rocks occur in the hanging wall of the Hercules fault paralleling the trend of the fault for several levels and apparently pinching out up dip. An en echelon pattern of these dikes exists along the entire extent of the structure. Below the 800 level a merging footwall fault with a steep easterly dip, known as the Mercury, has taken up a large part of the displacement. Other faults west of the Mercury have distributed vein fragments in a step-pattern, and many interesting mining problems have been encountered here.

Mineral Constituents

The assemblage and relationships of the minerals of the Hercules ore body constitute its most outstanding characteristic. Iron is the primary constituent of the most abundant mineral. These include magnetite, siderite, pyrite, pyrrhotite, and grunerite, which is an iron-magnesium silicate related to tremolite. A detailed study of the mineralogy was undertaken in 1950, by Dr. Bronson Stringham, the results of which are reported in *Mining Engineering*, December 1953. This study showed that the minerals fall naturally into four main stages based on their relative time of deposition: silicates, carbonate, oxide, sulfides.

In Stage 1, the silicate stage, biotite, andradite garnet, grunerite, adularia and chlorite were formed. These were the earliest minerals followed by those of Stage 2, carbonate, represented by siderite alone, and Stage 3, oxide, represented by magnetite alone. Through these initial stages iron was in abundant supply. Stage 4, sulfides, is characterized by a profuse supply of sulphur, and abundant lead and zinc, but with a decreasing supply of iron. Some copper, arsenic and antimony were also available at this time. Under these conditions pyrrhotite, pyrite, chalcopyrite, arsenopyrite, jamesonite, galena and sphalerite were formed. Jamesonite, galena, and sphalerite can be separated from the other sulfides since they formed in the absence

(*Continued on page* 82)

Fig. 3—Looking down the dip of the Hercules fault on the vein model

Sources of Energy for Electric Generation in the Two Decades Ahead

Challenge of Nuclear Fuel Will Act as Stimulant to Coal Industry

By PHILIP SPORN
President, American Gas and Electric Co.

IN order to arrive at a reasonably reliable projection of sources of energy for the somewhat distant future, it is necessary first to make a good estimate of total energy requirements for the period in question. Such an estimate in turn depends upon the view taken of over-all anticipated economic development.

Expected Economic Activity

To begin with, then, certain conclusions about the level of economic activity which is believed to be expected in the United States during the next two decades, the period to be examined, will be stated. A number of factors are especially relevant in arriving at these conclusions. We are experiencing a population boom which gives every indication of continuing for some time to come. We have achieved a high level of material welfare with a relatively steady but increasing trend over the past several decades. We have good reason to hope that that trend will continue. The very fact that we are engaged in a world-wide struggle between the free and the communist world that seems destined to go on for a long time to come makes it essential that we maintain and increase our economic strength.

We must be economically strong in order to support an adequate system of armament; we must also produce enough goods and services to take care of the peacetime requirements of our growing population at ever higher standards of welfare; we need to produce enough in addition to help strengthen our allies and potential allies who are less fortunately situated than we are.

Now, among other things, what all this means is that our energy requirements will have to increase very substantially year by year. Ours is a technically advanced economy, which is another way of saying that it is a high energy economy. This view of our present situation and future needs sets the base for a quantitative projection of how much energy we will have to make available in the future.

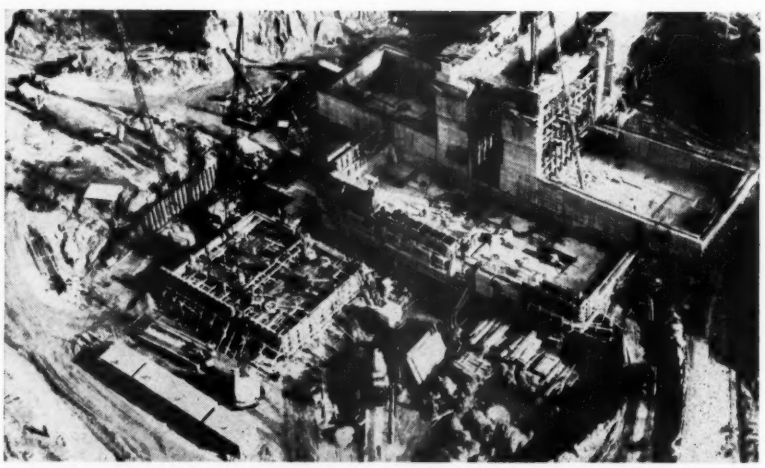
Energy Requirements

Today the United States fulfills its energy requirements by bituminous and anthracite coal, oil, natural gas, and water power. Total current use represents 1.48 billion tons of bituminous coal equivalent annually. Recent predictions about the country's requirements 20 years hence place the figure at approximately 2.75 billion tons of bituminous coal equivalent annually. The distribution of this future supply among coal, oil, and so on, is in itself a very complicated problem. Study of the subject, taking into account the availability of various classes of fuel and the prices at which they will be available, is among the most important resource problems

About the Author

Philip Sporn graduated from Columbia University School of Engineering in 1917. He joined the American Gas & Electric Co. in 1920 and subsequently rose through the ranks to become chief engineer of the company and its subsidiaries in 1933. He was elected president in 1947. In 1952 he was elected president of the Ohio Valley Electric Corp., an enterprise organized to supply the electric power requirements of the Atomic Energy Commission's diffusion plant in Pike County, Ohio.

Mr. Sporn has devoted a great deal of time and effort to the study of nuclear energy, and particularly to possibilities of its application in the field of power generation. He has participated in the activities of numerous committees in the field of nuclear energy and served on the U. S. Delegation to the 1955 International Conference on Peaceful Uses of Atomic Energy.



The Shippingport plant, shown here under construction, is scheduled for operation next year. Forecast is that nuclear power costs will be reduced to the competitive level but only after some years of painstaking engineering development and experience with a wide variety of large experimental operating units

TABLE I

PROJECTED TOTAL ELECTRIC POWER GENERATION BY ELECTRIC UTILITIES IN THE U. S. IN 1975

Class of Consumer	Billions of Kwh
Residential	545
Commercial	250
Industrial	900
Miscellaneous	55
Total Consumption	1,750
Losses	250
Total Utility Generation	2,000

that warrant attention. But the question of sources of energy for over-all requirements of the long-term future is hardly a manageable subject for an article of this kind; thus the scope of this paper will be limited to energy requirements for electric power and the sources of such energy. Even such a subject may seem overly ambitious. But, if we consider not the remote future but only the next two decades, it should be possible to make reasonably reliable projections.

A look 20 years ahead is commended by a number of considerations:

1. Two decades are definitely within the range of interest of almost all people now engaged on the problem.
2. The trend in availability of competitive fuels for this period can be gauged with reasonable accuracy.
3. The effect of atomic energy in particular can be gauged for this period—for whether one is inclined to be optimistic or pessimistic in his outlook about nuclear power, the chances are that an examination of the problems involved in developing competitive atomic plants in the next 20 years will yield projections that lie within a relatively narrow range.
4. Finally, the next two decades may witness a focusing of world-wide forces affecting us, which may be the most critical that will confront this country for perhaps several hundred years ahead. Energy policies will play an important role in the working out of these forces. This is particularly true from the standpoint that, if any action needs to be taken looking toward a change in policy or the projection of a new program to make new sources of energy available, there is not very much time to lose if effective help is to be obtained prior to the critical conjuncture of turning points in our history of the next several decades which may affect us for centuries.

Two Trillion Kwh by 1975

We begin with total generation by utilities in the United States of nearly 550 billion kwh in 1955. Using the techniques that are customarily applied in projecting growth in the American Gas and Electric Co., which, of course, take into account its expectations concerning the national economy, the corresponding figure for 1975 will be close to two trillion kwh. A reasonable breakdown of this load would show the several classes of use as given in Table I.

FRB Index

Residential consumption is estimated on the basis of 54,500,000 customers in 1975 with an average annual consumption per customer of 10,000 kwh, as compared with 44,500,000 customers today and slightly over 2750 kwh average use. Industrial consumption results from an estimate of 245 for the Federal Reserve Board Index of Industrial Production in 1975 and industrial consumption of 3.675 billion kwh per point of the index, or 900 billion kwh. (It excludes generation for self-use, which we estimate at about 250 billion kwh.) Commercial and miscellaneous consumption represent extrapolations of present trends related to projected growth in population and income. The important figure here is the 900 billion kwh for industry.

The estimate of 245 for the FRB Index of Industrial Production for 1975 requires explanation. It is nearly twice the 1953 figure of 134, but is not overly optimistic. In the same period, 1953-1975, the number of production workers in the country, which in 1953 was close to 14,000,000, is expected to increase to nearly 17,000,000. Taking account of the fairly well-established trend in working time, manhours worked may be expected to rise in the same interval by a much smaller amount—an estimate is eight percent. Obviously then the bulk of this large increase in the FRB Index has to come about as a result of the continuation of the rising long term trend in the output of the average worker.

The measure of this is seen in the nearly trebling of large power sales per point of FRB Index which has been assumed. And the nub of the increase is that the 1975 worker, with fewer hours on the job than his counterpart in 1953, will be much more productive and that the increased productivity will require tremendously more electric energy per hour of work. The 1953 figure of nine kwh per manhour will probably be nearly 19 kwh per manhour by 1975.

With industrial energy requirements of 900 billion kwh and the residential, commercial, and other uses of power that we believe are clearly in the offing, you end up with the total energy requirement of two trillion kwh.

Hydro Power

The installed hydro-electric generating capacity in the United States in 1955 was not quite 25,000,000 kw or approximately 21 percent of a total generating capacity for the utilities of 114,550,000 kw. But the percentage of hydro power in the total of electric energy is on a declining trend; hydro is bound to play a consistently diminishing role as our economy expands and the expansion in total power requirements continues to exceed the growth potential of our hydro reserves. By 1975 the Department of the Interior expects that 14,000,000 kw of hydro will have been added to the existing 25,000,000 kw of hydro installations. The Federal Power Commission estimates as much as 30,000,000 kw of additional hydro between now and 1975, or a total of 55,000,000 kw by that date.

A good prognostication would be that we shall have about 48,000,000 kw installed hydro by 1975 and total capacity of all kinds of 382,000,000 kw. This would mean that two decades from now slightly over one-eighth will be hydro and that this capacity will account for 250 billion kwh, or one-eighth of all generation. The balance, or 1.75 trillion kwh, will be thermally generated. Solar, tidal, and wind energy in the United States can be disregarded for the period in question. Despite the attempted revival of Passamaquoddy and the growing interest in solar energy, it does not look as if such sources will count for much between now and 1975.

Thermo-Nuclear Power

The balance of 1.75 trillion kwh to be generated by thermal power will either employ nuclear or fossil fuels. First, estimates for nuclear fuel will be given and then, having determined how much will have to be supplied by fossil fuels, estimates of the respective parts that will be supplied by oil, gas, and coal will be supplied.

The large experimental nuclear power projects which are now well beyond the early planning stage total altogether about 1,000,000 kw. These reactors are either owned outright by the Atomic Energy Commission or are being installed under the reactor demonstration program of the Commission, or in some cases are to be owned and paid for entirely by private companies wtihout governmental aid.

This is a substantial program. A million kilowatts is a sizable amount of capacity from any point of view. Nevertheless, the effect of nuclear fuel and its impact on the energy picture of 1975 in the United States, although not insignificant, is likely to be relatively small. One of the important things to remember is that, while all the promising types of reactors are being undertaken on a large developmental scale, we should not be surprised by a period of slowdown between the completion of each of the prototypes and the inception of additional reactors of similar species. Each experimental reactor must be

built and operated to obtain the first test results and operational verifications of engineering projections. These reactors will then have to undergo a phase of further experimental and development before the design and construction of more advanced additional projects in the same family is decided upon or before wholly new types evolve.

A substantial period of technical development and adaptation precedes the perfection of major scientific discoveries. We are now witnessing this process in the development of nuclear power plants. In view of the formidable technical-economic obstacles to be overcome, progress in making economically competitive nuclear installations is not going to be as dramatic as has generally been assumed. The obstacles will undoubtedly be overcome and nuclear power costs reduced to competitive levels, but only after some years of painstaking engineering development and experience with a wide variety of large experimental operating units.

Shippingport Plant

Hence, it is not believed that the total installed nuclear generating capacity by 1975 will reach a level much above 20,000,000 kw in the United States. This will then represent some 5.2 percent of the total generating capacity at that time, but, owing to the higher load factor that is likely to be available to the nuclear plants, this capacity should account for approximately 150 billion kwh, or 7.5 percent of the total 1975 utility generated energy. Of course, if the fossil fuels should for any reason fail to meet the requirements adequately, nuclear plants will be installed more rapidly. On the other hand, there is the possibility that even the estimate of 20,000,000 kw in atomic plants by 1975 may be too optimistic, because the time that it will take to solve some of the technical and economic problems may be greater than any of us now realize. Some notion of the time span which may be involved in the development of competitive nuclear power may be obtained from the recent estimates of Admiral Rickover with regard to the Shippingport plant scheduled for operation next year. Admiral Rickover has estimated that the cost of power from the operation of the first core in the Shippingport reactor will be some 52 mills per kwh. The second core, he estimates, should produce power at 39 mills per kwh, and the third core, which may be ready for operation in 10 years, may reduce the cost of power to 14 mills per kwh. This is still well above a realistically competitive cost level.

While there can certainly be differences of judgment with respect to the speed with which competitive atomic power will take its place in our economy, the estimates presented herein represent a reasonably well founded judgment of the probable order of magnitude of atomic energy that will be produced in the United States by 1975.

It is hoped that the impression has not been left that Admiral Rickover's account of what is to be expected on costs from our first commercial-sized experimental power reactor illustrates anything more than the point that the first prototype of any reactor will represent the first step in a relatively long progression of steps from higher to lower costs. Even now it may be possible to build reactors, although we have not yet built them, which will produce power at a cost reasonably close to that which the Shippingport reactor will not approach until 10 years after initial operation; the reason, of course, that we are that confident today is because of all the experimental work which has gone on in the last 10 years.

The picture with regard to the fossil fuels is susceptible of fairly accurate analysis. Let us start with natural gas.

Natural Gas

In 1955 natural gas supplied some 96 billion kwh, or 17.5 percent of the total electric energy, and 22 percent of the thermally generated energy of the United States. The figures, going back to 1950, of percentage of thermal energy generated with natural gas are given in Table II.

TABLE II
PORTION OF TOTAL ELECTRIC UTILITY THERMAL ELECTRIC ENERGY GENERATED BY GAS

Year	Percentage
1950	19.1
1951	20.9
1952	23.3
1953	23.6
1954	25.7
1955	22.0

The conditions which have resulted in the continual rise—until reversed in 1955—in the proportion of total electric energy generation accounted for by natural gas in the past two decades, and particularly since the end of World War II, are not likely to prevail over the next two decades. The rapid extension of the gas pipe line networks is nearing completion and the emphasis now is being directed to gas storage facilities in order to avoid the need for selling large quantities off-peak at extremely low prices. The very rapid rise in gas demand for premium uses at higher prices has made such storage attractive and has stimulated construction of more storage facilities.

The rapid expansion of demand has, in turn, intensified the upward pressure on gas prices in recent years. The same process is likely to continue and exert increasing pressure on natural gas reserves. This pressure is reversing the price advantage that natural gas has enjoyed over alternative fuels until now.

As demand expands and strains natural gas reserves and as prices rise, it will become less economical to burn off-peak gas under boilers. Available supplies are likely to be asigned to those electric utilities located close to the sources of gas supply and to an even greater extent to those special high value uses in which natural gas is especially suitable and in which for one reason or another price is not the important factor.

Appraisals of the role of natural gas in supplying 1975 energy requirements vary considerably in large part because of uncertainty as to recoverable reserves. Some of the loading estimates of the total marketed production two decades hence, are given in Table III.

TABLE III
PROJECTED MARKETED PRODUCTION OF NATURAL GAS IN THE U. S. IN 1975

Authority	Trillion Cu Ft
AGA	22
Dept. of Interior	19
Wallace E. Pratt	15
Paley Commission	15.2

Adopting from this range of figures 19 trillion cu ft as a likely estimate for marketed production, it is possible to make a fairly reliable estimate of the amount of power that will be generated with natural gas. The maintenance of natural gas' present share of the electric utility generating market would imply the consumption of about three trillion cu ft for almost 16 percent of all gas production in 1975, compared to 1955 when use for power accounted for only about 12 percent of total marketed production. An expansion of this magnitude in the utility market does not appear feasible when reviewed against the expected expansion in demand for the higher value uses and estimates of ultimate reserves. Probably a closer approximation is that gas for utility generation in 1975 will be approximately 1.7 trillion cu ft, which will represent expansion of close to 50 percent in gas consumption by electric utilities. (Wallace E. Pratt, one of our distinguished geologists, has ventured a somewhat higher estimate of 2.4 trillion cu ft.) With the Btu figure at 1,050 per cu ft and an average performance of 9000 Btu per kwh, this represents 200 billion kwh or 10 percent of total 1975 generation.

Oil

In 1955 oil accounted for 36 billion kwh, or 6.68 percent of the total generation and 8.3 percent of thermal

TABLE IV
PORTION OF TOTAL ELECTRIC UTILITY THERMAL ELECTRIC ENERGY GENERATED BY OIL

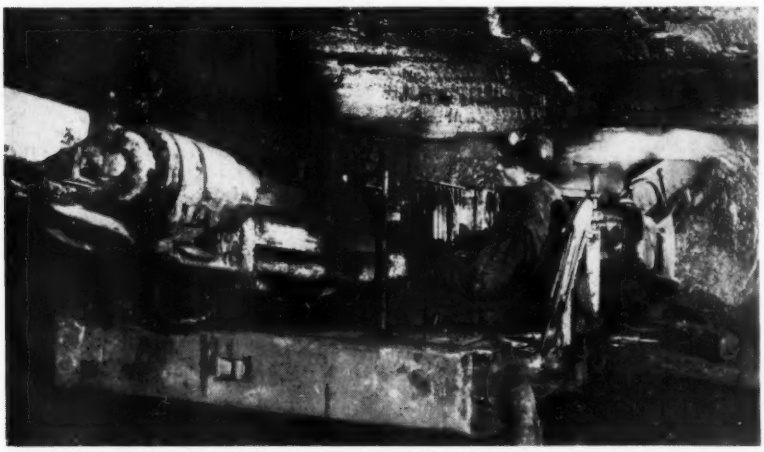
Year	Percentage
1950	10.2
1951	7.7
1952	7.4
1953	8.7
1954	6.67
1955	8.3

generation. The figures going back to 1950 are given in Table IV.

As in the case of natural gas, projections of petroleum's role in the energy economy in 1975 are highly dependent upon estimates of total recoverable reserves. While these vary over a considerable range, nevertheless leading estimates of total oil use in 1975 are quite close to one another:

ESTIMATED TOTAL OIL USE IN THE U. S. IN 1975

Authority	Billions of Barrels
Bureau of Mines	5.0
Wallace E. Pratt	4.9
Paley Commission	5.0



It is estimated that in 1975 coal will furnish about 1.3 trillion kwh, requiring some 488,000,000 tons of coal. This country is fortunate in that it has the necessary coal reserves

As in the case of natural gas, oil is being diverted to higher value uses, such as motive power, for which economic or convenient substitutes are not available. There has been a rapid growth in demand for the lighter petroleum fractions which is expected to continue. This shift in the composition of petroleum demand has led to changes in the petroleum refining process to diminish the portion of the barrel of oil which remains as residual oil, the oil used for power generation; even residual oil itself is finding higher value uses in the making of petroleum coke, asphalt, and other materials. In the international sphere the United States may expect to meet increasing competition for the world's petroleum resources so that imports are less likely to be available in the necessary quantities at favorable prices for utility generation. Western Europe is straining its coal reserves and looking toward oil to fill the gap in its energy supply. Accentuating this, growth in the underdeveloped countries of the world is likely to result in a very rapid rise in their petroleum demand.

These factors will increase the competitive pressures on world petroleum markets.

It appears unlikely that, in the face of the anticipated expansion in demand for the lighter fuel oils in their many specialized uses, the prospective diminution of our petroleum reserves and the rising prices likely to result from the growing demand and rising costs of petroleum exploration and development, the quantity of petroleum burned under utility boilers could expand the almost 300 percent necessary to maintain its present share of the market.

Based upon the accepted conversion figures, an estimate of use of oil for power production is 143,000,000 barrels, a 90 percent expansion over 1955 consumption. (Here again Mr. Pratt believes a somewhat higher figure—182,500,000 barrels—is justified.) An estimate of a 90 percent expansion over 1955 would mean oil-fired power production equivalent to over 91 billion kwh or roughly 5 percent of the total.

Coal

In this country we are extremely fortunate in our coal reserves. To arrive at the portion of the electric energy to be generated by coal we are, therefore, able to simply subtract the percentages of the total requirements that will be supplied by hydro, nuclear fuel, gas and oil. It will be recalled that these are 12.5, 7.5, 10 and 5 percent, respectively. Thus the total amount to be taken care of by coal is 65 percent, or 1.3 trillion kwh. Again using an average performance of 9000 Btu and assuming coal at 12,000 Btu average heat content, this results in a 1975 coal utilization of 488,000,000 tons.

A few remaining observations might be made. Our industrial system should be able to provide the country with the additional 275,000,000 kw of capacity that will have to be built by 1975, and we should be able to make the fuel available to the extent required by the new capacity. As to the latter, the most important observation is that the role of coal will with the years become increasingly prominent.

This country is in an especially favored position in that we have the necessary coal reserves.

Foreign Situation

Parenthetically, the favorable situation of the United States in respect to coal must be contrasted with the situation of many areas abroad in which fossil fuels are even now available only at high cost or where the areas are rapidly approaching such a condition. In such areas the rate at which nuclear power plants will be built to supplement and even replace plants using fossil fuel is likely to occur more rapidly than in this country. The present British program is a good illustration of the point. It is also very probable that our interest in strengthening our friends abroad in relation to their energy program will be a stimulant to our own experimental work on nuclear reactors and that our manufacturers are likely to play an important part in supplying equipment for reactors abroad under conditions that make their work in that field more attractive economically at an earlier date than in the United States where the situation with regard to coal reserves is so favorable.

But coal in the ground is not available until it is mined; in that process there will be required vast increases in capital facilities and, therefore, in capital expenditures and considerable development in all phases of coal mining: technological, management, and operational. It is true that there is on the horizon a young, vigorous, and serious competitor in the form of nuclear fuel but, considering the opportunities that are presented to coal and to the coal industry, it is not believed that the effect of the impending challenge of nuclear fuel will be anything but a stimulant to the industry —to its owners, managers, technicians, and to the people engaged in the actual mining. In responding to that challenge all of them will enhance their own welfare. That is important but, what is more important, they will make an immeasurable contribution to the welfare and safety of the people of the United States, and indeed of the whole western world.

A need to increase the rate of heading advance speeded up the transition to air leg drilling

Air Leg Drifting at Kerr-Addison

By J. R. RAMSELL
Manager
Kerr-Addison Gold Mines, Ltd.

ALTHOUGH all stoping operations at Kerr-Addison Gold Mines, Ltd. in Northern Ontario had been converted to air leg drilling with Tungsten carbide tipped bits by 1951, conversion in development headings to the same method of drilling lagged behind. The reasons for this lag were as follows:

1. There was insufficient evidence that better performance could be obtained by the change.
2. There was no particular pressure to increase the rate of development advance.
3. There was inertia on the part of supervision and development crews to try out these new drilling techniques in development.

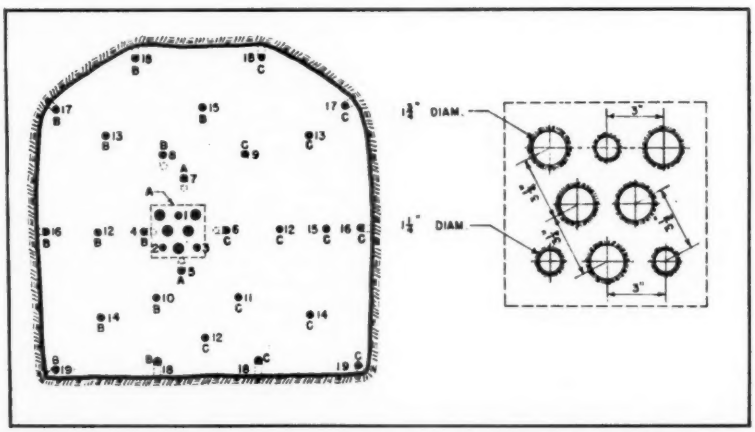
In 1953 these conditions changed because of the urgent need to develop quickly the new levels rendered available by completion of a shaft deepening program. In order to schedule this work suitably, heading advance had to average over 300 ft per month instead of 180 ft then being obtained.

Previous to 1953 a two-shift cycle was standard practice in a heading with cross-sectional dimension of 8½ ft x 8½ ft. On the breaking shift, two men using two 3½-in. column mounted drifter machines with detachable steel bits, set up, drilled off and blasted a round varying in length from 6 ft to 10 ft depending on the rock hardness. On the mucking shift, two men using an Eimco Model 21 loader, scaled, mucked out, installed track and ditch, and brought in the drilling gear. Unless two headings were available on the same level, other work had to be provided for the mucking crew for part of the shift. Generally this part of the shift's work was not on contract; consequently good productive results were not obtained.

Improved Cycle

With the air leg equipment and detachable tungsten carbide bits, a one-shift cycle is used, with a three-man crew mucking out, drilling off and blasting a 7½-ft round. Normally drifting is done on a two-shift per day basis with a four-hr time lapse between shifts for clearing smoke. Thus an average daily advance of 15 ft with six men is obtained, as compared with an average daily advance of eight ft by four men in the former method. The mucking part of the cycle requires about three hrs time. Three-ton Granby type cars are used with the Model 21 Eimco loader. Two men switch, tram an average distance of 1300 ft and dump the cars. The loader operator scales and cleans up along the sides while the train is being dumped. A short turnout is provided every 250 ft for changing cars. Mucking track, consisting of 10-ft rail sections welded to ties, is installed by the drift crew. A track crew installs permanent 20-ft rails on timber ties during the drilling operation, as required.

Drilling off the 35-hole round requires about three hr, with each of the three air leg machines drilling from ten to thirteen 8-ft holes. A nine-hole shatter cut including five 1¾-in. holes which are not loaded, is normally used. The diameter of the remainder of the holes is 1¼ in. The whole round is



Standard air leg "Shatter cut" drift round used in advancing 8½ ft by 8½ ft headings. Letters indicate holes drilled by each machine; numbers indicate firing rotation

blasted simultaneously using tape fuse and igniter cord. Setting up, tearing town, installing air and water lines, loading and blasting, lunch and travel time, occupy the remaining two hrs of the shift.

Tapered Coupling Carbide Bits

Air leg drills of 2½-in. cylinder diameter are used which weigh 91 lb complete with legs. Drilling is done with detachable four-wing tungsten carbide tipped bits connected to the ⅞-in. hexagonal drill stem by a double tapered coupling. The 1¾-in. bits used in drilling the large cut holes are similarly connected by use of a tapered bushing so that the larger coupling can be connected to the standard ⅞-in. drill shank.

The air leg machines, drill steel and other gear are handled in and out of the face on a special truck equipped with a rack on one side to carry the drill steel.

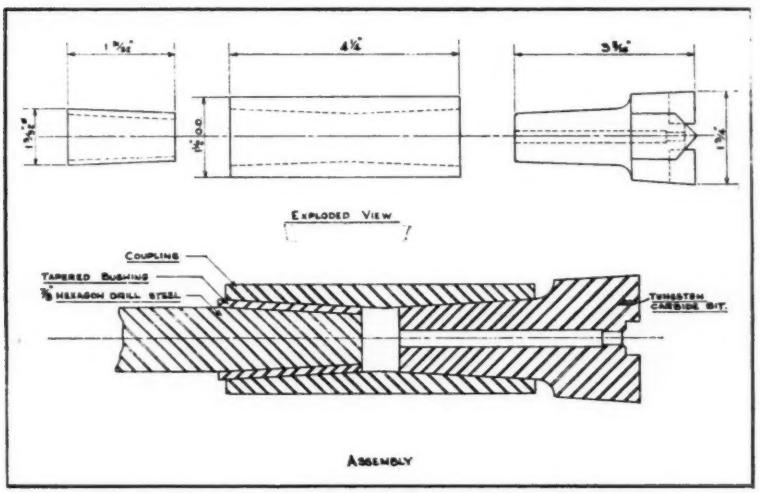
When the air leg equipment was first used in horizontal development, the drift miners were reluctant to accept the change. Some of them felt it below their dignity to muck out and lay track. However, once they got used to it, they preferred it to the older method, as the equipment was much lighter to handle and their work was more interesting because it was more varied. Some of the older miners who had been transferred to lighter jobs tried the new equipment out and were pleased to go back driving drifts with it. In order to ease the change-over, the contract rates were increased by 15 percent and then reduced back to the normal rates in graduated steps of 5 percent over a four-month period. Previously, with steel bits, contract rates depended on rock hardness. With the substitution of tungsten carbide bits in place of steel bits this differential was eliminated to the satisfaction of all concerned. To date the best monthly advance obtained by a six-man crew has been 402 ft. The average monthly advance is 325 ft as compared to 180 ft by the former method.

The Air Leg Drill on this Continent was Pioneered in Stoping Operations in Canada. This Report Tells How it has Been Successfully Adapted to Driving Development Headings in a Canadian Hardrock Gold Mine. Using the Light-Weight Drill with Tungsten Carbide Insert Taper-Connection Bits Has Brought About More Efficient Cycling and a Cost Reduction of About Five Percent in the Drifting Operation. This Saving along with Several Other Important Advantages Make a Strong Case in Favor of the Air Leg.

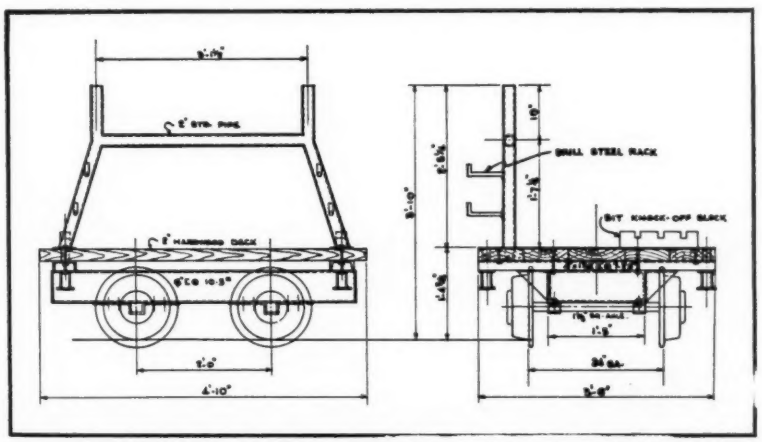
TABLE I

Period	Method	Feet of Advance	Feet Per Round	Man Shifts Per Round	Feet Per Man Shift	Lb Powder Per Foot	Direct Cost Per Foot*
1952	Std.	13,140	8.4	3.7	2.3	12.05	18.14
1953	Std.	4,016	8.0	3.6	2.22	12.34	18.34
1953	Air Leg	12,922	7.3	3.4	2.12	10.98	17.99
1954	Air Leg	13,829	7.4	3.5	2.13	10.43	17.53

* Includes charges for rock drill maintenance, drill steel and bits, and compressed air.



Drawing of the tapered bit connection used at Kerr-Addison



The drill gear truck used to transport drilling tools to and from the face

Performance

Table I shows the comparative performance of 1952, 1953, and 1954, by the two methods.

From the experience to date, we find the following advantages are being obtained through the use of air leg equipment in driving of drifts and cross-cuts:

1. A sharp increase in the rate of development heading advance.
2. The use of standardized drilling equipment.
3. New men are able to learn more quickly how to drill with this type of equipment as compared with old type.
4. A reduction in pounds of powder per foot of advance as indicated in the table.
5. An added economy in that it is no longer necessary to find work for the mucking crew for part of a shift.

New Stoper Drill Design Combines 30% Reduction in Weight with 10% Faster Drilling Speed

Use of modern materials in new Le Roi-Cleveland S-10 Stoper results in easier handling.

With the introduction of the new Le Roi-Cleveland S-10 Stoper, great strides have been made in easing the work-load of miners. At the same time, their productivity, in terms of footage drilled per shift, has been increased.

New stoper uses aluminum feed leg to help decrease weight as much as 30% and provide better balance. This type of feed leg, already so successful on Le Roi-Cleveland Air Legs, contributes greatly to weight reduction: The S-10 with 18-inch steel change weighs only 79 lbs!

10% faster drilling speed results from a combination of design features: The new valve is timed and ports are arranged so that a maximum flow of air is delivered to the piston on both downstroke and upstroke. Hard-hitting, rock-shattering blows result, along with a rotation that's strong enough to turn the steel in the worst kind of drilling.

The variable feed-pressure control also adds greatly to the performance of the S-10. It has a wide enough range to feed the machine properly against all kinds of rock. Maximum drilling speed is attained. At the same time, both bit life and machine life are increased.

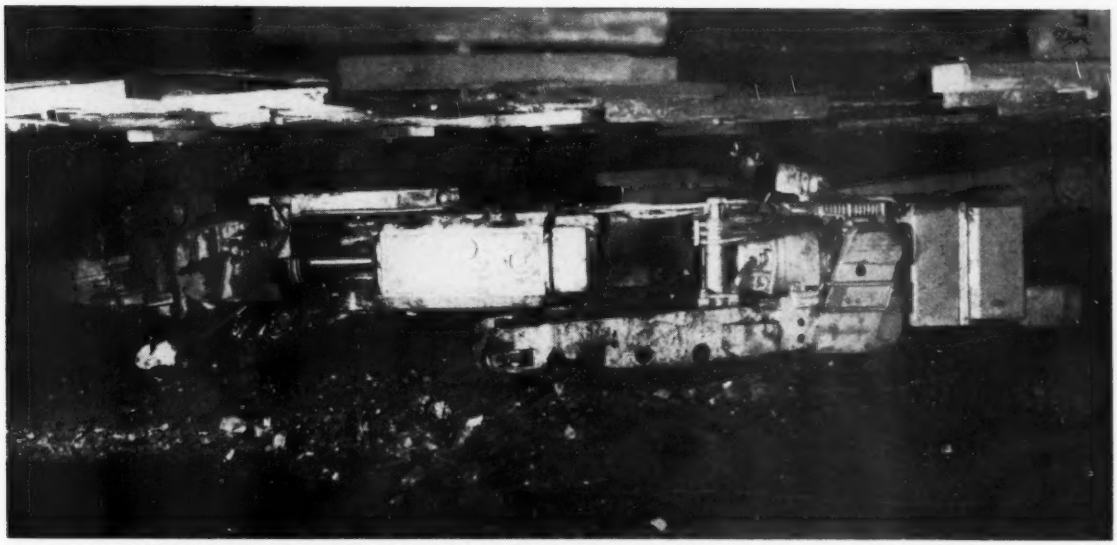
Exclusive steel puller permits the use of collared steel. This is of special advantage in tight ground, where stuck steels used to be a problem. The new steel puller, consisting of only 5 parts, also makes stoper operation safer. Since the steel never leaves the machine, the danger of falling drill steel is eliminated. The new S-10 Stoper is also available with tappet-type construction for shankless steel.

Three sizes of feeds are available. The S-10 can be supplied with 18, 24, and 30-inch steel changes for 7/8 and 1-inch hexagon or quarter-octagon steels, with or without collared shanks.

LE ROI Division of Westinghouse Air Brake Co., Milwaukee 1, Wisconsin, manufacturers of Cleveland air tools, Tractair, portable and stationary air compressors, and heavy-duty industrial engines. Write us for information on any of these products.

RD-83

Five Years of Continuous Mining



An estimated eight percent of the total underground output in 1955 came from continuous mining

Changes in Machine Design and Improvements in Auxiliary Equipment Have Brought Continuous Mining Far in Five Years. Much Remains, Though, With Improved Roof Control and a Change in Mining Systems Topping the List of Important Problems to Be Tackled

By ROBERT I. BILLINGS
Assistant to Production Manager
Rochester & Pittsburgh Coal Co.

A BIG question before the mining industry today is "Do we always have to require a long range planning and experimental period before we get a practical machine? Must we continue to use old customs and practices because our forefathers did?"

In 1949 the Rochester and Pittsburgh Coal Co., Indiana, Pa., and the coal industry as a whole, were of the opinion that within the next ten years, the majority of the coal produced would come from Continuous Mining. During the year of 1949, R&P placed in service 12 continuous miners; ten of these miners were placed in thin seams that varied from 42 to 48 in. Now, seven years later, we find that the majority of coal produced is not from continuous mining as predicted. In 1952, continuous mining production had increased to approximately 8,200,000 tons and in 1955 it was estimated that 25,000,000 tons were produced or approximately 8 percent of the total underground output. In 1955, R&P's continuous mining production was 22 percent of its deep mining and was mined almost entirely by the ripper type miner.

This article deals with the company's experiences in the problems encountered with continuous mining relative to thin seams.

Had to Modify Design

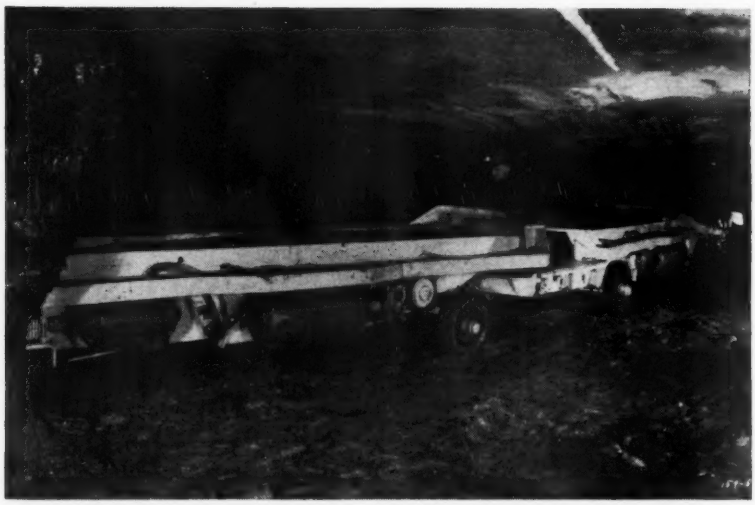
One of the first problems was in the design of certain components of the machine itself. There is need for refinements to the machine, as time will indicate, in the application of any new machine.

In the early stage, we had the problem of gathering fine coal in the face area in order to give a clean bottom so that the machine could operate normally. On our earlier models, the pickup device was a scoop which pushed fine coal to the face; this scoop had a tendency to climb allowing fine coal to accumulate under the "cats" of the machine, causing the entire machine to climb. This condition resulted in downtime while the fine coal was removed by shovels in advance of the machine. Subsequent changes in pickup devices have produced the latest type of scrolls which are operated mechanically and extend right and left of the machine cleaning the face area from rib to rib.

Considerable trouble to hoses and conductors was encountered in the turntable area of the machine from abrasion caused by spillage from the hopper. The addition of spillboards and guards of belting have alleviated this condition.

Hydraulically, the first machines gave considerable trouble because of type and placement of hoses. Improvements were made by using double strength hose in trouble areas and re-routing other hoses where failure occurred because of unnecessary bending and mechanical stresses. Hydraulic controls have been improved by relocation of the main control valves for ease in operation and maintenance.

On our original machines, downtime was experienced from breaking shear chains, swing chains, and swing chain pins. Today, the trend is away



Portable belt conveyors offer great possibilities for continuous transportation

from the use of chains in this area to direct acting hydraulic pistons.

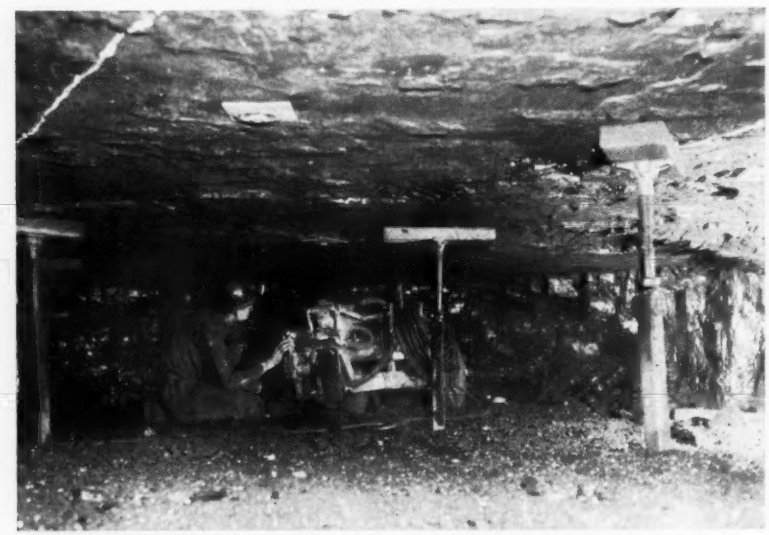
Changes have occurred on the machine in the type of cutting head and chains. Rotary or drum type chains have been installed to replace the six chain head; however, our experience in the seams of coal working, did not prove this rotary head to be successful. Presently, we are trying the improved head which has five chains and pineapples giving the machine a 39-in. head.

In our method of mining, at certain times it is desirable to anchor the trailing cable on the opposite side of the machine; this has been accomplished by adding an anchor to that side.

Our machines, when first bought, had the cutting motors water cooled. We experienced trouble in maintaining piping to the water jackets and also maintaining the threads in the jackets themselves. Since we found it impossible to maintain this cooling system, we have discontinued the water jacket with no ill effects from overheating.

Electrically, the only change of any significance was the addition of a thyrite discharge resistor in the control circuit and the rearranging of the control circuit so that the high inductive voltage built up by the contactor coils could be reduced within its own circuit without causing damage to the main motor circuit.

Our experience with the boring type miner has been limited, however, our problems consisted mainly of timing shaft maintenance, hydraulic hose breakage, dozer blade breakage, and inability to keep the machine on a straight course.



There is a definite need, in low coal roof bolting, for a proper drill to work with the continuous miner

Effects on Preparation Plant

Another problem of continuous mining that required adjustment was the sudden burdening of our coal preparation plants with fine sizes. Our plants had to cope with problems different from those for which it was designed. It was necessary to decrease the tons per hour through-put of the plant because of additional fines (¼ in. by 0) which are more difficult to clean in order to maintain the same quality of coal. In two of our plants, two additional Diester tables were added. The reject from continuous mining increased four percent as compared to conventional mining. There is more dirt contaminating the coal since the miner encountered both the roof and bottom during the cutting operation. In addition, it is almost impossible to eliminate impurities at the face, particularly thin draw slate or cannel coal that adheres to the coal which usually means a loss of coal in the refuse. In most of our mining, coal is discharged by the miner on to the floor and is then loaded into the shuttle car by a loading machine. The loading machine is also a source of dirt even though care is exercised in loading.

Haulage Has Been Bottleneck

Inadequate haulage behind the miner has kept the machine from becoming a true continuous miner. Our first experience was the use of a shuttle car having an extended boom that remained under the miner as a surge car. This surge car discharged into another shuttle car that traveled between the surge car and the discharge point at the belt. This method was not too successful from the standpoint of flexibility in turning crosscuts. Today, we are using the loading machine behind the miner in conjunction with shuttle cars. R&P put into use one of the first extensible belts behind the miner. Since the installation of this belt, improvements have been made by the manufacturer, and it is now being used to mine a large area of coal that would not be economically feasible with shuttle cars alone. Belts of this type should, in time, replace the shuttle car.

Roof Support Problems

At times it is difficult to timber behind certain types of miners. As a general rule, our standard timbering plan requires one row of posts on four-ft centers in a 16-ft place. This has proven a safe and economical plan since it can be performed without stopping the mining operation. When bad roof is encountered, 5 by 7 by 14-ft crossbars are used and the tonnage takes a proportionate drop. Supplies must be handled manually at least 38 ft from the face, close clearance over the machine impedes timbering, and because of the location from the face

of the hydraulic jacks, crossbars are sometimes set without the use of the jacks. One must also consider the maneuvering of the machine and turning of crosscuts as one of the less productive phases of mining, however, under crossbars, these cycles become even more time consuming.

We have tried roof bolting as a method of timbering on development and have found it costly because of necessary interruption to mining in order to bolt the face properly. There is a need, in low coal, for a proper drill to work with the continuous miner.

Importance of Training

Because of the high production expected from the continuous machines, it was necessary to change the thinking of our personnel. Any outage on equipment meant that all productive work stopped, which was not necessarily true in conventional mining. In order to educate the miners, time studies of the various operations were made to determine the most efficient way to use the machine. Studies were made on repair jobs and lubricating the machine. This information was given to supervisory personnel to enable them to train their crews in the most efficient method of operation, and to have work plans made in advance of breakdowns.

In any continuous mining operation, keeping outage time to a minimum becomes No. 1 on the list of necessary musts. Our supervisor of maintenance was sent to the various manufacturing plants where he observed the assembling of the machines. In addition, manufacturing representatives have been available for consultations. Mechanics were rotated on various repair jobs to gain experience.

The supervisory force learned the importance of checking closely on carbide bits, the cost of which can easily get out of hand. Sharp bits meant less vibration to the machine and greater penetration. The number of bits being replaced because of dullness and breakage is noted daily on the assistants' reports.

In order to follow the performances of the machines, extensive records are kept at the mines.

Other related factors influencing progress of continuous mining have been ventilation, dust control, visibility, and rockdusting.

Ventilation and Rock Dusting

We try, at all times to keep 10,000 cfm of air circulating over the miner. The line brattice is kept in advance of the operator. The amount of air circulating has a definite bearing on dust control and visibility. We use a minimum of three sprays on the miner and also use a spray behind the line brattice to allay dust where it is confined to a small area.

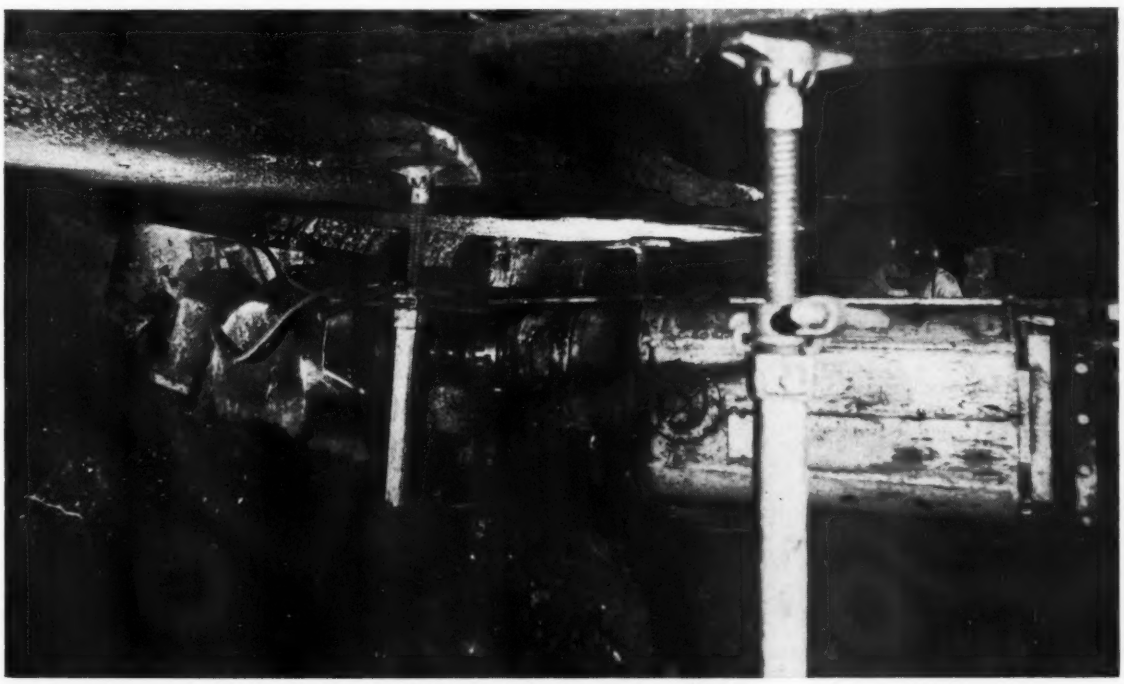
Rockdusting is done during the shift with advantages taken of an outage. On shift dusting is by handcasting and is followed up by machine dusting after the miner moves to an adjacent place. With the advent of wet rockdusting, there is the possibility of rockdusting without interference to the face operation.

The Industry's Needs

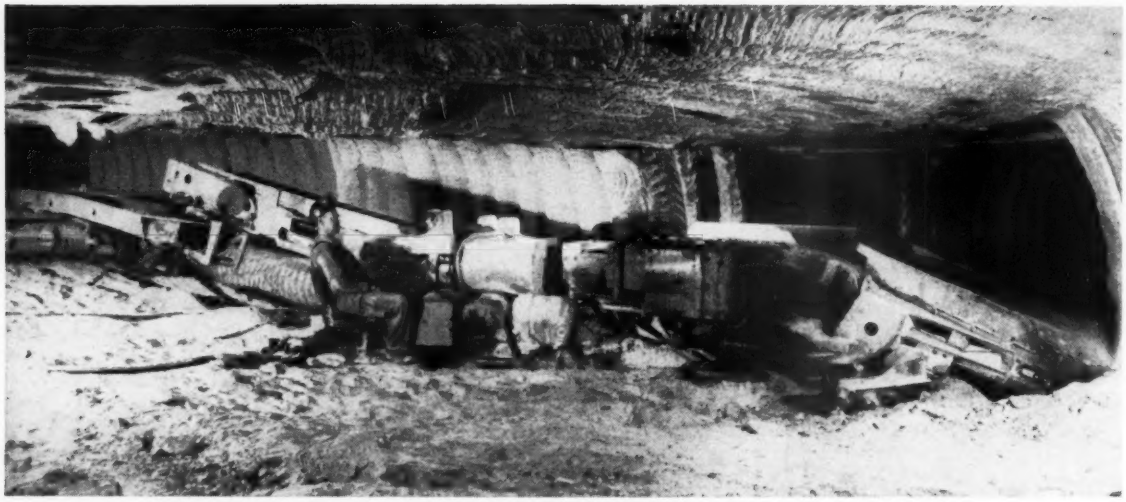
Continuous mining has undergone slow changes in the past years under various conditions and systems. It was evident in 1955 at the Coal Show in Cleveland that many manufacturers have faith in the future of continuous mining. It was also evident that operators have faith in the future of continuous mining by the increase of continuous mining production and from the reports of production performance unequaled in past years' records. As our prediction of 1949 gains momentum, let us give continuous mining the impetus needed, and by that I mean:

(a) The auxiliary equipment necessary to make it a true continuous miner
(b) Possible changes in mining system to blend with the equipment
(c) Better or improved means of roof control
(d) A method that will eliminate downtime to clean up spillage, rockdust, change bits and lubricate the machines
(e) And, as the coal reaches the outside, a more efficient means of recovery at the cleaning plants

These problems are not new; and a successful solution to these problems can be obtained with intensive cooperation between the operator and manufacturer.



Roof support in low seams is a problem



Panoramic view of a continuous miner from cutter bar (right) to extensible 24-in. conveyor (left)

Carlsbad Potash Basin Activities

Pictures Help Tell the Story of Advanced Mechanization in a Leading Industrial Minerals Mining District. Continuous Miners, Underground Extensible Belts, Rubber-tired Bulldozers, and Piggy-Back Units Are Commonplace in the Rapidly Expanding Potash Operations of New Mexico

By EARL H. MILLER
Assistant Resident Manager
United States Potash Co.

THE five producing Carlsbad potash companies have been very active in production and made many improvements in their mines and refineries in 1955. A sixth potash company, National Potash Co., is entering the potash field by sinking two, 15-ft diameter shafts, to an approximate depth of 1750 ft, laying approximately 22 miles of water line from the Caprock area, constructing necessary auxiliary and office buildings, and access roads. The Santa Fe Railroad is extending its railroad line from the track servicing Duval Sulphur and Potash Co. eight and one-half miles to the new plant site. The National Potash Co. expects to be in limited production during the first quarter of 1957.

A New Operation

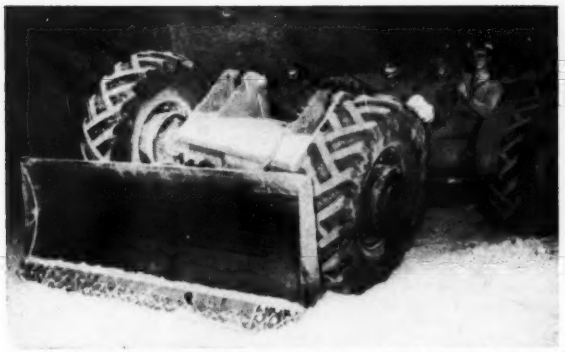
National Farmer's Union recently merged with Kerr-McGee Oil Industries, Inc., and Phillips Chemical Corporation to form Farm Chemical Resources Development Corporation for developing and operating a seventh potash property in the Carlsbad Potash Basin. The shaft site has been selected and the preliminary work of coring the overburden and salt formation and testing for water with a 10-in., cable tool, drilled hole, has been completed. The first shaft will be a man and material shaft, although some ore will be hoisted from it for operating a pilot plant which will be in operation while the second shaft is being sunk and the mill constructed. It is planned to have the property in production sometime in 1959.

Duval Sulphur and Potash Co. has installed a 100 hp, rubber tired, diesel powered, bulldozer underground and a diesel powered truck for use of the powdermen. This truck is equipped with the necessary tools, blasting machines, etc., and has space for enough powder and detonators to last two powdermen a full shift. Duval has also installed a panel belt 30 in. wide and 615 ft long with a capacity of 500 tph to feed crushed ore onto their main line belt.

The International Minerals and Chemical Corporation made improvements on their main ore hoist to increase the hoisting capacity. These changes entailed enlarging the skips and increasing the speed of the automatic cycle by the addition of closer

About the Author

Earl H. Miller was trained at Washington State College, receiving a B. A. degree in mining in 1935. His experience includes ten years with Pend Oreille Mines & Metals Co., Washington; five years in Pennsylvania operating a limestone mine and one year in Turkey helping set up development for a coal mine. Mr. Miller has been assistant resident manager for the U. S. Potash Co. the last three years.



Diesel four-wheel, rubber-tired bulldozer (left) in operation underground. Powdermen at Duval Sulphur and Potash Co. use a diesel truck (right) specifically adapted to blasting work

control devices on the automatic hoist control switches. New hoisting ropes were installed with three electrical circuits embedded in the hemp center of each rope, which will be used for telephone communication during shaft maintenance and inspection, and will be available for slack rope indication and further automatic control. International has also modernized and increased the capacity of its potassium sulphate plant and contracted for a new office building of modern Southwest architecture at the plant site.

Underground, International has installed brake cars with streetcar type magnetic brakes operated by the locomotive operator to increase hauling efficiency by making possible greater speeds with heavier trips on downhill hauls, and universal cutting machines to improve efficiency in undercutting.

Continuous Mining

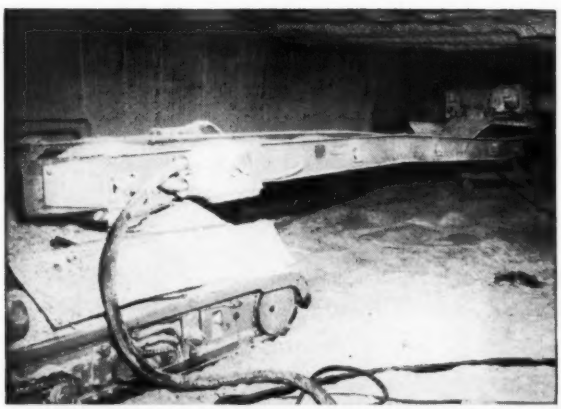
At Potash Company of America, mining equipment and methods are being changed from loading machine, shuttle car, and locomotive haulage to continuous mining machines and conveyor belt haulage. Five of the new continuous mining machines were designed and built in their own shop and have proved so satisfactory that seven more are being built of the same design but with greater capacity. The ore from these machines will be handled entirely by belt conveyors. Panel belts extending 2500 ft at right angles to the main line conveyors carry the ore from shuttle conveyors, one in back of each miner machine, to the 30-in. main line conveyor system, which will eventually extend 21,560 ft. The main line conveyor carries the ore into a 3000-ton bin ahead of the skips. This conveyor system in Potash Company of America is the longest underground conveyor system in the country and will eventually have a total length of over 7½ miles.

The Southwest Potash Corporation modernized its mining by the purchase of universal cutting machines to replace shortwall undercutters and a four-wheel diesel tractor for general clean-up in mining areas. On the surface during 1955, Southwest initiated a modification program in its mill flow sheet, as well as increasing the capacity of the crushing plant and mill.

Expansion Program

United States Potash Company started modernization and an approximate 20 percent expansion of its refinery. In order for the mine to produce the additional tonnage required by the refinery expansion, a loading pocket and a complete crushing and loading plant were installed at the company's No. 2 shaft. A third 70-ton diesel electric locomotive and 20 narrow gauge cars of 40-ton capacity were purchased to haul the additional tonnage the 16 miles from the mine to the refinery.

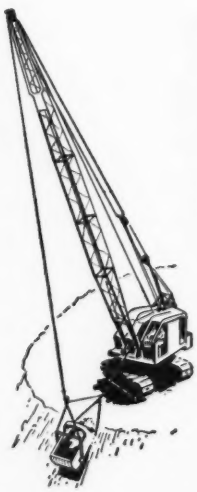
General improvement underground during 1955 consisted of a complete conveyor system of 24-in. extensible belts, 36-in. panel belts to handle the production from a continuous mining panel. Mine cars hauling the ore from the panel belts to the skip pocket will be automatically loaded by a hydraulically operated car handler. For improving conventional mining, additional jumbo type hydraulic blast hole drills, universal undercutters, a large screw crusher and another 40-ton diesel electric underground locomotive were acquired.



Piggy-back unit on tail end of continuous miner (left) feeding ore onto first section of extensible belt. A 24-in. extensible belt (right) carries ore from the face and transfers it to a 36-in. cross-over belt (note distinctive pattern in roof and walls left by the continuous miner)

It's time to compare...with LINK-BELT SPEEDER

"First time a shovel has kept us rolling like this!"



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New Link-Belt Speeder performance is so outstanding, it has completely revised existing production standards . . .

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Speed-o-Matic power hydraulic controls—a Link-Belt Speeder exclusive—make every move fast, sure, easy. With them, you can boost output—often as much as 25% or more!

From track treads to boom tip . . . every detail of a Link-Belt Speeder reflects advanced engineering, skilled craftsmanship, precision construction and quality materials.

And look at this list of standard and optional features — independent swing and travel . . . independent rapid boomhoist . . . torque converter . . . third drum . . . reversing clutches for both hoist drums . . . and power hydraulic-actuated swing brake, to mention only a few.

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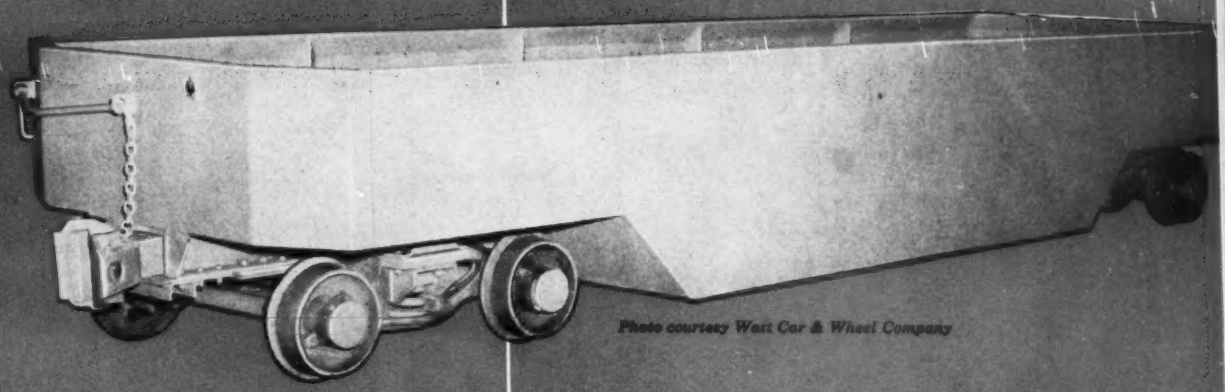

Photo courtesy Watt Car & Wheel Company

Barnes and Tucker Company continues to specify

NATIONAL

equipment for all 8-wheel mine cars

On its latest order for 100 eight-wheel Watt mine cars, Barnes and Tucker Company's Lancashire No. 15 Mine specified National equipment *throughout*. This includes National NC-1 trucks, Naco Steel Wheels, Willison Automatic Couplers, and National Rubber Cushioning devices.

This latest re-order makes—*and keeps*—the entire fleet of rotary-dump cars *100 percent National equipped*. And this means that the Barnes and Tucker Mine has one of the most modern fleets of mine cars in existence. *Modern* because the cars are safe to operate at high speeds... *modern* because they are efficient and minimize spillage... *modern* because they will continue to keep maintenance costs low.

Think of tomorrow today...
and modernize your cars the National way.

NATIONAL
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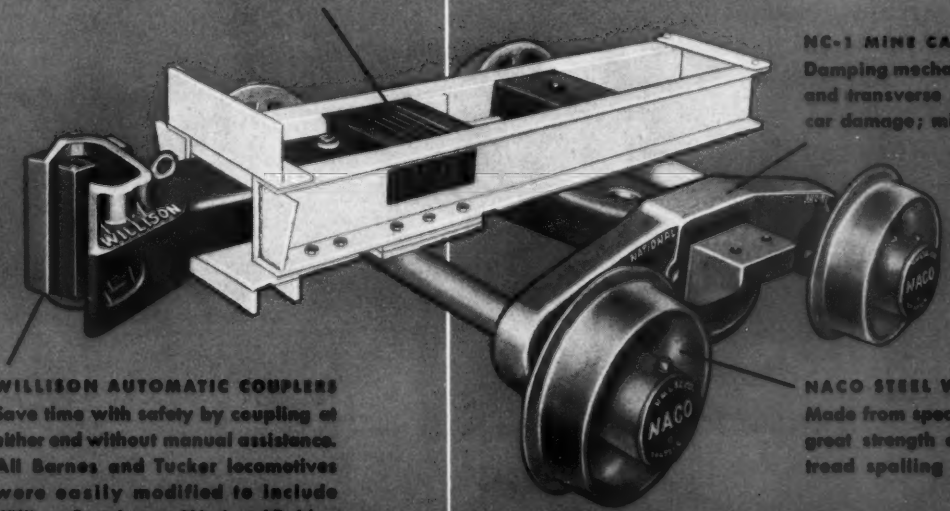
NATIONAL MI-230
All National Rubber Cushioning devices provide soft initial action, high absorption, and maximum protection.

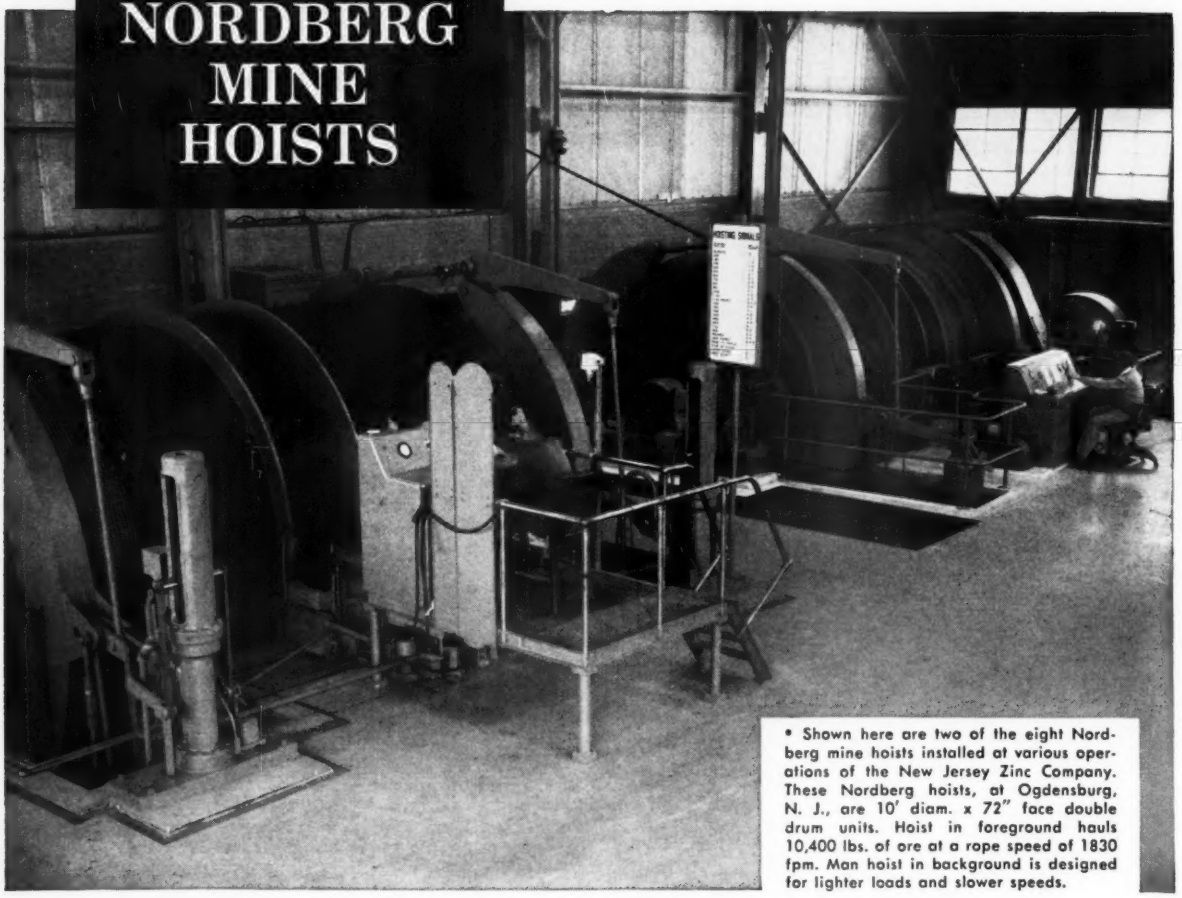


NC-1 MINE CAR TRUCK
Damping mechanism controls vertical and transverse oscillations; reduces car damage; minimizes spillage.

WILLISON AUTOMATIC COUPLERS
Save time with safety by coupling at either end without manual assistance. All Barnes and Tucker locomotives were easily modified to include Willison Couplers and National Rubber Cushioning devices.

NACO STEEL WHEELS
Made from special Naco cast steel of great strength and ductility; reduce tread spalling or flange breakage.

NORDBERG MINE HOISTS



• Shown here are two of the eight Nordberg mine hoists installed at various operations of the New Jersey Zinc Company. These Nordberg hoists, at Ogdensburg, N. J., are 10' diam. x 72" face double drum units. Hoist in foreground hauls 10,400 lbs. of ore at a rope speed of 1830 fpm. Man hoist in background is designed for lighter loads and slower speeds.

. . . Standard of the Mining Industry

For over 50 years, Nordberg has specialized in building large or unusual hoists to specification, and is the source of the most progressive hoist engineering advances in the mining industry. The most modern tools, skilled craftsmen, and a widely experienced engineering staff combine to produce mine hoists which enjoy an unexcelled reputation for safe and dependable operation throughout the world.

With the trend toward larger tonnages and more powerful hoists, greater emphasis than ever is being placed on the design ability of hoist manufacturers. Here Nordberg has achieved consistent success and is today in the position to build both conventional and friction type hoists according to the requirements of the mining industry.

Write for further details, or ask for Bulletin 190. *NORDBERG MFG. CO., Milwaukee, Wisconsin.*

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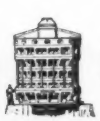

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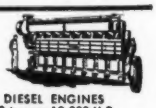


DIESEL ENGINES 10 to over 12,000 H.P.

Why Trailing Cables Fail

Coal mining's lifeline, the trailing cable, is designed to withstand rugged mine service but its operating limits are definite

Cable Damage Has Its Source in One of Five Causes . . . (1) Improper Insulation, (2) Excessive Tension, (3) Mechanical Damage, (4) Electrical Overload or (5) Poorly Made Terminations and Joints. All Are Controllable

By STEVE BUNISH
Mining Cable Engineer
Anaconda Wire & Cable Co.

THERE is no mystery about trailing cable failures. Aside from manufacturing deficiencies which occasionally occur, practically all failures can be accounted for by recognition of operating conditions that exceed trailing cable limitations.

A trailing cable, like any other piece of mining equipment, has certain limits within which it is designed to operate trouble free. When these limits are exceeded cable damage or failure is initiated. The cause for failure can be readily determined if the "blowout" occurs at the same time the cable is damaged. It is more difficult to determine the cause if total failure is delayed for a period of time after the original damage occurred.

This discussion will concern itself primarily with conditions that initiate cable damage and ultimately result in cable failure.

Sources of Cable Damage

The three basic components of all trailing cables are (1) copper conductors, (2) conductor insulations and (3) a protective sheath or jacket over the cable as a whole. Injury to any one of these components marks a potential "blow-out."

There are five sources of damage that can lead to eventual cable failure. These are (1) improper installation, (2) excessive tension, (3) mechanical damage, (4) electrical overload and (5) poorly made terminations and joints.

Maintenance Begins With Installation

Effective cable maintenance begins with installation on the machine. Caution should be exercised so that no kinks are formed. The practice of pulling a cable out of a supply coil lying flat on the mine bottom should be avoided. A twist will form for every turn taken out of the coil, a condition illustrated in figure 1. Each twist will become a permanent kink when operating tension is applied. Figure 2 suggests equipment that can be adopted for installation of cables free of twists or kinks.

Terminations should be such that the individual conductors are of even length. They should be so attached that even tension occurs on all conductors since uneven conductor tension will lead to kinking and cable deformation.

Excessive Tension

Many "hard to explain" cable failures are the direct result of excessive tension. A cable that has been "stretched" no longer has the balanced construction that is so vital to long service life. Once this balance is destroyed cable failures are accelerated. The following summarizes the effect of tension on the basic components of a trailing cable:

Copper Conductors: Tension on the conductors subjects the individual wires in the strand to compression and shear. The small wires are damaged and will break more easily during bending or flexing.

Conductor Insulation: Tension elongates the conductor insulation. The elongated insulation is vulner-

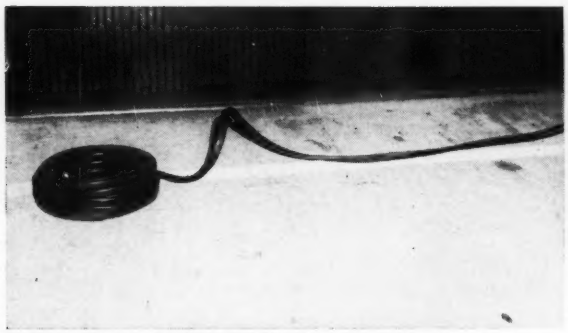


Fig. 1—When cable is pulled out of a supply coil it twists, which leads to later kinking

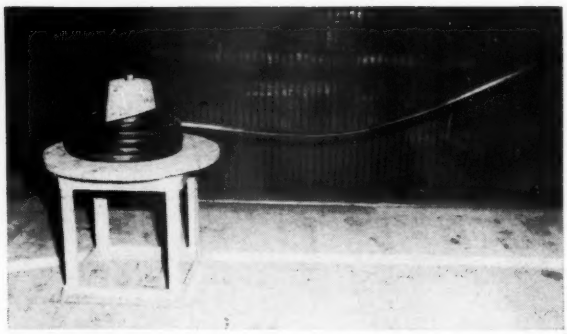


Fig. 2—One solution is to place coil on a swift or turntable, allowing the cable to be unreeled

able to compression cutting. It will rupture more easily when it is crushed against the stranded conductor during run-overs. The insulation will have a tendency to creep over the conductor at a splice or termination.

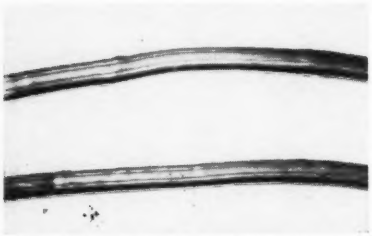


Fig. 3—Knots on the cable exterior indicate kinked conductors resulting from excessive tension. Each kink is a potential wire break

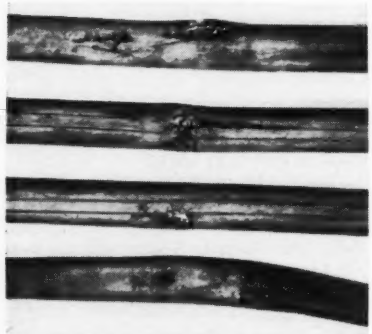


Fig. 4—These four sections have been subjected to mechanical damage and should be repaired

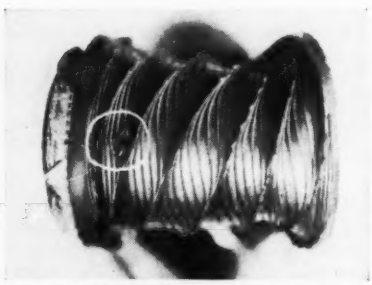


Fig. 5—This insulation was adjacent to a conductor that had been subjected to crushing. Circled section shows a break in the insulation

Protective Jacket: Jackets under tension lose a considerable part of their inherent high resistance to mechanical damage. Jackets under tension are vulnerable to cutting, tearing and abrasion.

Whenever a cable is stretched the copper conductors take a permanent set. They will not return to their initial state of elongation. The insulation and jacket are also stretched but they want to return to their original state of elongation. In this respect they are like a stretched rubber band that is suddenly released. The rubber band will return to approximately its initial length. The difference in properties of rubber and copper when subjected to tension will cause the conductors to kink as shown in figure 3.

When kinking occurs individual wires in the kinked section of the conductor are damaged, and continued bending of these kinked sections will cause them to break. This type of failure is not obvious from an examination of the cable exterior, but it can result in a hidden fault that is difficult to locate.

Mechanical Damage

Mechanical damage is one of the most prevalent sources of trailing cable failures. Agents initiating mechanical damage are (1) cutting, (2) compression or crushing, (3) punctures and (4) abrasion.

In extreme cases of mechanical damage the failure occurs instantaneously and the cause for failure can be assigned on the spot. In less severe situations cable components are injured and become "latent" failures. When failure does occur it sometimes is difficult to assign the proper cause.

Cuts and punctures in the jacket and insulation open a path to the cable interior, a condition that is especially aggravated in a wet mine. Sections of wet cable become a shock hazard and current leakage in the vicinity of the cuts will track and burn the jacket. Individual wires in the conductor are corroded and will eventually break. The cross-sectional area of the conductor is decreased, impairing both the electrical and physical characteristics of the cable. Figure 4 shows sections of cable damaged by crushing and puncturing.

Examination of cable sections subjected to crushing show conditions ranging from slight cable deformation to almost complete severance at the point of impact. A compression break in an insulation that has been subjected to crushing is shown in figure 5. Cables so damaged can no longer perform efficiently the function for which they were intended. The conductors are usually deformed or damaged and become focal points for wire breakage upon continued bending or flexing.

Properly compounded Neoprene jackets make excellent protective coverings for trailing cables since they have a high degree of resistance to the abrasion normally encountered in mining operations. However, abnormal conditions, such as damaged guides or sheaves, will wear away the jacket in localized sections of cable. The exposed insulations do not have the physical toughness of the jacket and they are more susceptible to injury and potential cable failure.

Electrical Overload

The temperature of the conductors, insulations and jacket are all elevated when trailing cables are subjected to an electrical overload. Resistance of the copper is increased, voltage drop in the cable is increased and a reduced voltage is supplied to the machine, automatically calling for more current which adds to cable heating.

Trailing cable insulations and jackets exhibit maximum resistance to physical abuse at mine temperatures. The ability of these rubber components to withstand abuse decreases as the temperatures increase—hot rubber cuts and tears easily—and conditions which normally cause few cable failures suddenly become a problem. At elevated temperatures the tough jacket has lost much of its resistance to cutting, crushing, tearing and abrasion.

The section of cable that remains on

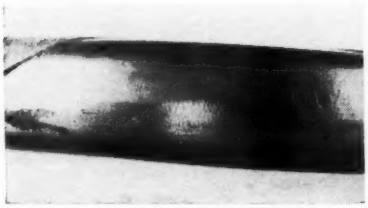


Fig. 6—A cable jacket exposed to elevated temperature becomes age hardened and brittle. Cracks and crazing occur upon bending or flexing

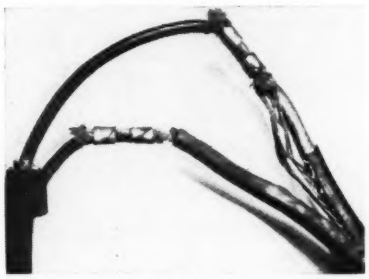


Fig. 7—A poorly made joint. Conductors are of uneven length and a tension load will not be equally distributed among the conductors. In addition, the grounding conductor is improperly terminated

the reel is most likely to be damaged by electrical overloading. Layering on the reel hinders ventilation and heat dissipation and the current rating of the cable is reduced. Ambient temperatures in the vicinity of the reel are high. Continued exposure to elevated temperatures will age the jacket making it hard and brittle causing crazing or cracking upon subsequent reeling. An example of jacket crazing caused by exposure to elevated temperatures is shown in figure 6.

Splices—Make Them Right

A poor joint such as that illustrated in figure 7 reduces the effectiveness of a trailing cable. Much work has been done in recent years to improve both splicing materials and techniques but the solution for the perfect splice is yet to be found. It is therefore imperative that every advantage be taken to make the best splice possible with the materials available. Some common weaknesses in splices which accelerate failures or damage are as follows:

(1) Splice has low tensile strength—it is easily pulled in two.

(2) Individual wire damaged during application of splicing ring or sleeve.

(3) Splice too bulky, it will not pass easily through existing cable guides or over small diameter rollers or sheaves.

(4) Insulating tapes or covering poorly applied. Water allowed to enter the cable interior.

(5) Failure to balance the length of individual conductors, resulting in uneven tension on the conductors.

A good serviceable splice has the following characteristics:

(1) High tensile strength.

(2) Balanced conductors — equal tension on each conductor.

(3) Small outside diameter.

(4) Low resistance electrically.

(5) Adequate electrical insulation.

(6) High degree of resistance to fatigue which results in wire breakage.

(7) Covering capable of keeping moisture from entering the cable interior.

(8) Can be made by an individual possessing ordinary skill with tools.

A well-made, permanent type splice with a vulcanized covering approaches the above characteristics with good resistance to fatigue being the most difficult to achieve. It is a good practice to limit the number of temporary splices permitted in any one length of cable. When this limit is reached the cable should be removed and permanent repairs made. Repairs to damaged sections of cable could also be made at this time.

Ways to Increase Cable Life

Following is a list of steps which have proven effective in prolonging cable life:

(1) Prevent twisting or kinking of cable during installation: a kinked conductor is a damaged conductor.

(2) Avoid excessive tension—if you can hold on to the cable while it is being payed off the reel or taken up on the reel without being pulled over—the tension is just about right.

(3) Use the largest size cable possible for the application. Take advantage of the extra tensile strength and current carrying capacity of the next larger size. It is more economical in the long run.

(4) Keep run-overs to a minimum. Any form of crushing is a potential source of rupture in the insulation and jacket.

(5) Reverse cable ends periodically. The end on the reel may be damaged by long time exposure to elevated temperatures.

(6) Remove damaged sheaves, guides and rollers. Use the largest size sheave and roller feasible. Make certain cable guides are large enough for splices to pass through freely.

(7) Repair cut or crushed cable even if a blow-out has not occurred.

(8) Provide a spare cable. Remove cable with temporary repairs and make permanent repairs. This will pay off especially in wet sections.

(9) Keep water out of the cable interior.

(10) Keep a record of what caused failures. It will point out where steps must be taken for more effective maintenance.

Keep a record of what causes cable failures. It will point out any weakness in present maintenance practice.

With few exceptions, the Plateau orebodies are tabular and flat-dipping

Mechanized Mining on the Colorado Plateau

Seldom has a better opportunity been given to mining men for application of advanced methods

By HAROLD B. SPENCER
President
Centennial Development Co.

THE phrase "mechanized mining" is a pretty loose term and it might be well to first decide on a definite meaning. Practically all mining on the Colorado Plateau is well mechanized in the sense that power driven equipment is in general use. A large part of the total production is obtained from small, erratic and discontinuous orebodies; and a variety of mechanical methods and devices are being used with success in their mining. However, operations such as these do not allow for a really systematic approach to ore production, since reserves are limited or nonexistent.

For the purpose of this discussion, we are going to by-pass this type of operation, and define mechanized mining to mean an integrated mechanical system for extraction of a relatively large and continuous orebody. Obviously, the first requirement for such a system is a blocked out orebody of size and value sufficient to justify the large capital expenditures necessary for underground development and mechanized equipment. Just where the dividing line is between orebodies which can be economically mined by such systems and those which cannot, must be determined in each individual case by careful analysis of a great many factors. It must be admitted that there are not too many proven orebodies on the Plateau which can meet the requisite of tonnage in a relatively continuous mass.

Plateau Orebodies

Before describing a few examples of present practice, it might be well to briefly go over the most obvious characteristics of the larger Plateau orebodies, at least as evidenced by discoveries made to date; and some of the problems which are common to the operations.

There are a number of characteristics common to Plateau orebodies which affect the choice of mechanized methods within the defined meaning. With few exceptions, the orebodies are tabular and flat-dipping, with a maximum of nine degrees in the case of the Big Indian District. Depth of an access point below the surface ranges from nothing to some 600 ft at the present time, although there is no reason to think that greater depths will not be attained in the future. Thicknesses range up to 20 ft averages in individual deposits, 90 ft in the case of recent discoveries in New Mexico, but considerable tonnage is presently being planned for mining to three ft or less; and large reserves of uranium metal are known in thicknesses measured in inches. However, it is questionable whether mining technique can keep pace with some stock promoters in putting this material in the ore reserve class.

The flat beddings which form the backs can be held in most cases with roof bolts over spans of 20 ft, but sloughing due to air slacking has given trouble in some areas. Formations below the ore beds are often extremely weak, and methods utilizing low level haulage with draw holes may run into difficulties in this regard.

Characteristic Problems

Ventilation is of more than usual importance for a number of reasons. One is the presence of radon gas, and although much remains to be learned about its effects and control, large amounts of air are unquestionably

needed. Another reason is the widespread use of diesel-driven equipment underground, again requiring extra ventilation.

Value of the ore is another important consideration. In most cases, sacrifices will have to be made and methods planned around 100 percent recovery of ore. Grade problems are further complicated by the AEC pricing schedule which makes it economical to blend certain low grades of ore with higher grades and come out with a net gain. The price schedule also contains an allowance for development work, which theoretically, at least, is payable only when the development is actually done; and it is self-evident that situations will arise where operators will find it advantageous to spend money on mine development which would not be economically justified under usual conditions.

Problems arise too from the isolated location of most of the properties. Power must usually be supplied from diesels, and water is often hauled over great distances. Lack of communications and ready access to supply sources cause difficulties. Labor problems are accentuated, and this factor is of great importance in application of mechanized systems, since specialized training is required for the individual jobs and integrated performances between the various workers is of much greater importance than in ordinary mining practice. In the same vein, vulnerability to work stoppages resulting from equipment break-down is greatly intensified.

With the foregoing factors in mind, plus many others of possibly lesser importance, operators have been working out mechanized systems for the few going operations now in real production or advanced development, and for the larger number of projects which are still in the planning stage. Following are some examples of both, all located in Utah, together with some notes on the equipment in use or being offered by manufacturers.

Diesel Equipment Used

In the Big Indian District, there are four or five producing mines which are presently being worked by some form of mechanized mining. The largest of these is the Mi Vida of Utex Exploration Co. which has had a very successful experience with rubber tired diesel haulage equipment, front end diesel tractor loaders and highly mechanized tractor mounted drilling jumbos, both for blast holes and roof bolting. Characteristics of this orebody approach the ideal for trackless mining in many respects, with convenient access points which allow haulage grades not exceeding 10 percent to reach all parts of the orebody from surface; thickness averaging 20 ft or more; backs which hold well with roof bolting, and a relatively consistent grade of ore. Despite this apparently ideal situation, which has resulted in an over-all tons per man-shift figure of approximately 22, the decision has been made to develop a low level haulage and draw hole system for future mining of the orebody. Many factors enter into the thinking behind this change, among them the decreased efficiency of the haulage units as lateral distances increase; increased maintenance costs on the main haulage-ways, resulting from gradual weakening of the backs and pillars as mined-out areas are extended, and opportunities for safer and more complete extraction of pillars on the retreat. Loading and haulage units will be replaced by the Gismo, which will load and move the ore to draw holes connecting with a mechanized, electro-powered track haulage system driven below the orebody. It is expected that the Gismo system, with its one-man operation for both loading and hauling from the face, will result in a further increase in tons per man-shift at Utex.

The efficiency and economy of the Gismo system, with its one-man operation for both loading and handling from the face, is unquestioned

Gismo and Draw Hole System

Adjoining the Mi Vida, Standard Uranium has been producing its entire output for some months with the Gismo and draw hole system, with access through a 2000-ft adit. This operation pioneered in use of the Gismo for stoping, and many problems peculiar to uranium mining have been encountered. Conditions are more difficult than at Utex, with steeper grades and more erratic ore, both in thickness and grade, requiring some selectivity in mining. However, one mucking and one drilling unit are now producing some 500 tons per day despite equipment troubles which are unavoidable in a new and experimental operation, and the efficiency and economy of the Gismo system is unquestioned.

Slushers and Track Haulage

Further north, the La Sal Mining and Development Co. orebody is being developed for mining by a mechanized system employing track haulage drifts along the down-dip limits of the ore bedding, with inclined slusher drifts up dip in the ore and branching drifts along the strike. Access is by a 600-ft vertical shaft, with a plant capable of producing 300 tons per day. Planning of a mining method for this orebody was influenced to a large extent by ore thickness, which ranges down to three ft and less; by the dip of the

About the Author

Graduated from Princeton University in 1937, Harold B. Spencer spent 10 years in various positions at underground metal mining operations in the West. He has headed the Centennial Development Co. of Eureka, Utah, mining contractors and consulting engineers, since its organization in 1947, and has supervised a number of shaft, tunnel and mine development jobs.

Power driven equipment is in general use on the Colorado Plateau

bed, which is approximately nine degrees; by the lateral extent measured in the direction of the dip, which will allow efficient use of the slushers in moving the ore from the upper limits down dip to the track haulage drifts, and by the high value of the ore, demanding complete extraction. Full scale mining of the orebody will not be commenced until development is practically complete, after which a retreating system will be started from the outer ore limits down dip and toward the shaft along the strike. It is expected that this method will result in exceptionally clean mining with a tons per man-shift ratio of about 12 when development is completed.

Highly Mechanized

An example of a somewhat smaller operation producing with a high degree of mechanization is the Maybe Mine, located in the extremely isolated Red Canyon area. Access is by a 2500-ft small tunnel, to reach a flat dipping orebody with average mining thickness of eight ft. In this case, almost all parts of the orebody can be reached with track grades not exceeding two percent and loading is accomplished with a small diesel front end loader dumping directly into two-ton mine cars, which are brought within 30 ft of the face and hauled by diesel locomotive to surface. Drilling is done entirely with jacklegs. With production on the order of only 150 tons per day, this operation is capable of a good tons per man-shift ratio of 15.

Two Methods for Low Heights

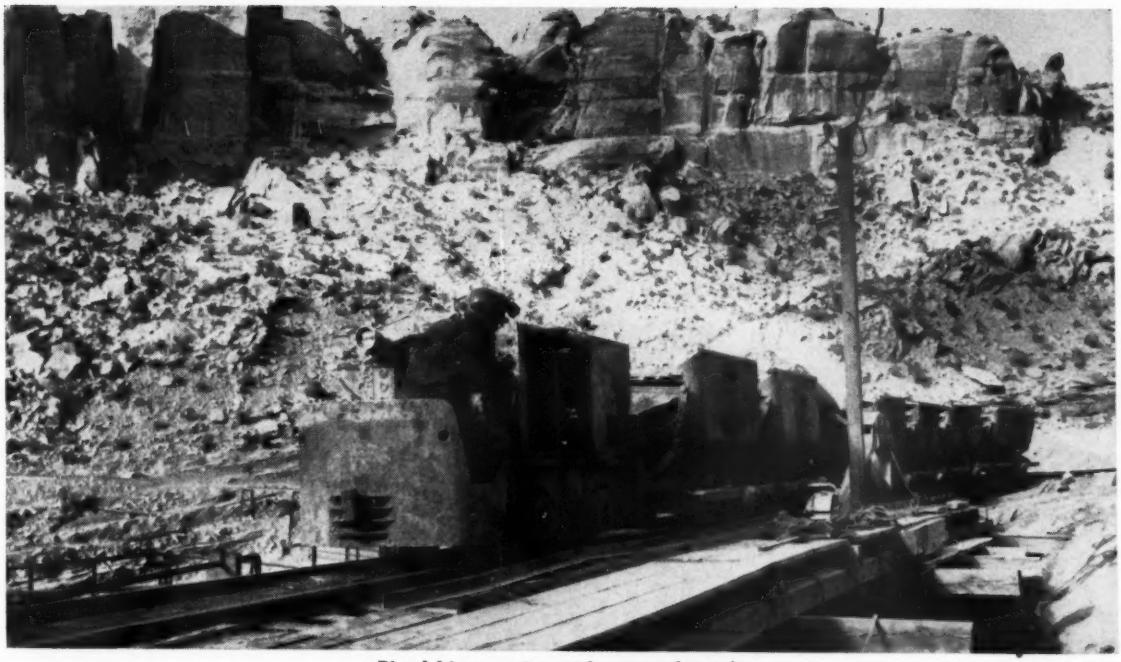
Planning and development work for mining of several more orebodies at 600-ft depths in the Big Indian District have been under way for the past several months. Conditions are similar to those at the La Sal operation, with particular emphasis on the low heights of the ore; and at least two different methods of approach are being considered. One company has commenced a track haulage system below the ore horizon, consisting in a short crosscut from the shaft loading pockets with draw hole raises to the ore, from which strike drifts will be run in the ore to the property limits in both directions. The ore horizon is also directly connected with the shaft for service purposes. This system is designed so that track haulage can be used in the ore drifts, but consideration is also being given to trackless equipment, including self-propelled, coal type shuttle cars and rubber tired tractor-trailer combinations for transport, and to either coal loaders on a tractor-mounted, low height, overshot loader. The Gismo, of course, requires too much headroom for this application, but the greater lateral range of the shuttle cars may enable them to compete on operating costs.

Another approach to the problem is being considered by a neighboring mine, again with similar natural conditions. Here it is planned, in effect, to substitute additional small hoisting shafts for the low level haulage system, accomplishing the same results of bringing the working faces within the economic range of the loading and primary haulage equipment. This equipment is again being planned around some sort of low height shuttle car, which in this case will be required to haul through openings maintained in the ore bed from the working faces direct to the shaft loading pockets. The maximum effective range of the shuttle cars will have to be determined by experimental operation from the original shaft, after which additional shafts, for hoisting of ore only, can be accurately spotted. Maximum permissible grades, together with variable bottom conditions, will also have to be taken into account in locating the shafts.

Shaft Sinking

The thinking behind this plan has been greatly influenced by the comparatively shallow depths and the ease of shaft sinking, cutting across the flat shale and sandstone beds, in the area; as compared with the relatively great lateral extent of the orebed, together with some difficulties which have been encountered in drifting along the flat beddings below the ore. It might be mentioned that Hecla's performance in sinking the U & I Shaft at a rate exceeding 10

Drilling problems are being handled with standard equipment but the trend is toward fully remote-controlled units



Diesel-driven equipment has proved popular

ft per day reflects these conditions, as well as an extremely well organized and mechanized shaft job. Consideration may also be given to 36-in. diam drilled shafts, which have been employed successfully in other areas on the Plateau, although not at depths exceeding 200 ft as yet. However they are sunk, there are opportunities for a high degree of mechanization of the hoisting operation in shafts such as these, through application of remote-controlled, elevator-type hoisting plants, using some features of the Koepe Hoist.

Loading and Primary Haulage

It can be seen that the main problems facing operators and planners of mechanized systems are in connection with loading and primary haulage. For thicknesses above eight ft, it appears that the Gismo, with further refinement and applied experience under Plateau conditions, offers a very promising solution. Due to its high efficiency in use of manpower and low first cost relative to its dirt-moving abilities, it may find application at lateral ranges beyond its normal maximum working range of two to 300 ft, thus allowing mechanized mining systems to be applied to smaller orebodies for which low level haulage and draw hole systems cannot be justified.

For many deposits of lower heights, shuttle cars, both tractor drawn and self-propelled coal types, will compete with slusher systems. Many models of shuttle cars have been offered for use on the Plateau, but all of them to date are light-duty, truck-type units, generally diesel driven and of low first cost, aimed at the large market made up of typically small, erratic Plateau orebodies. For real production service, operators are looking toward coal mining equipment, with its long and successful record of high tonnage production in very low backs, and to established manufacturers of hard rock mining equipment who are in a position to engineer and produce other types of low height haulage units. Due to the relatively limited market, manufacturers have been reluctant to bring out special models with the necessary modifications for this service. However, one major supplier of coal equipment is thought to be readying a rock model shuttle car with four-wheel drive and steering which is expected to fill the need. It will be an electric powered unit with cable reel. The four-wheel drive feature is considered to be an essential for operation under the conditions of slick bottoms and steep grades which are prevalent. In addition, one of the metal mine equipment companies has been devoting a good deal of time to the problem and expects shortly to offer a matched loader and haulage unit of low headroom design.

Drilling Trend

Drilling problems are being handled with standard equipment. Although the Plateau is primarily jack-leg country, mechanized mining demands the high unit production and efficiency which can be attained only by chain feed drifters on Jumbo booms with crawler type or rubber-tired mountings. The trend is definitely toward fully remote-controlled units as exemplified by the Gismo drill rig. Drill rigs for the mines with lower ore heights will have to be modified, but the same results can be accomplished and mechanized drilling will be of just as great importance.

Mechanized mining will expand on the Colorado Plateau as more orebodies with the necessary characteristics are discovered. Accomplishments to date have pointed the way and will be of real help to operations of the future. Seldom has a better opportunity been given to mining men for application of advanced methods which have been developed over the years and which will surely be developed in the future.

G. A. Shoemaker opened the Convention with a prediction of a bright future for the coal industry

The 1956 Coal Convention

Confidence in the Future Highlights Most Successful Meeting

COAL mine executives, operating officials, manufacturers of mining equipment, and mine suppliers from all over the country took a "busman's holiday" May 7-9 when they attended the annual Coal Convention of the American Mining Congress in Cincinnati. It was one of the most successful Coal Conventions ever held, if attendance at the various meetings and all-around enthusiasm are any criteria. To select any one part of the over-all, well-rounded program as the most outstanding would be difficult. They were all good.

Over 1700 were present to take part in the technical and general sessions of the three-day meeting, which fully covered the outlook for the coal industry and operating problems of both deep and strip mining and coal preparation. One marked development was the intense interest shown in maintenance and new concepts of management. This reflects a growing realization of the importance of these subjects in present-day coal mining. With the huge amounts of money being spent by the industry on mining equipment, operators are increasingly aware of the importance of keeping that equipment producing at its optimum rate as much of the time as possible.

Safety also came in for its full share of attention. The safety theme was woven through most of the papers presented, being considered an important factor in judging any piece of equipment or mining method.

Most of the credit for the outstanding program belongs to the national program committee under the chairmanship of G. A. Shoemaker, executive vice-president, Pittsburgh Consolidation Coal Co., which put together the fine program. Each paper was presented by a recognized expert in his field, many of them younger members of the industry. Months of hard work paid off in a realization that the coal industry is indeed a dynamic, forward-looking industry, one which has really bounced back from the doldrums of only a year or so ago.

Open With a Bang

The Convention was officially called to order Monday morning, May 7, by Mr. Shoemaker. He pointed out that our present scale of coal production represents just about the maximum capacity of our present mines and that future increases must come from new facilities or revitalized mines. The problem is compounded, he said, by the fact that perhaps a third of our present mines will be depleted over the next 10 to 12 years. Shoemaker suggested the possibility that the coal industry's development may parallel events in the iron ore industry. Need for new capital and further pooling of present mineral and financial resources will result in a closer relationship between the producer with his capacity and the consumer with his requirements. He concluded that the industry is faced with a long-term job that will require continual recruiting of top-notch men, but added there is enough adventure and personal opportunity in coal to attract the kind of talent it needs.

Howard I. Young, president, American Zinc, Lead & Smelting Co., and president of the American Mining Congress, then extended a welcome to the Convention. Young reviewed in a few words the progress of the coal mining industry over the past 35 years. "The American Mining Congress is doing the best possible job it can for the coal industry, the nonmetallics, the cement and the metal mining industries that it represents," Young said, "and I feel that we have been most fortunate indeed in having all these various divisions that have cooperated to the fullest extent in those things that are of mutual interest to all of us and of great benefit to the future prosperity of this country."

In a word of tribute to mining manufacturers, Mr. Young said that the men who develop, manufacture, and sell mining equipment are also doing an outstanding job, through their salesmanship and through their mechanical skills, in helping all branches of the mining industry to cope with

the many technical problems that are constantly arising.

Raymond E. Salvati, president, Island Creek Coal Co., and vice-president and director, American Mining Congress, presented "A Practical Look Into Coal's Future." Salvati pointed to the present trend towards coal company consolidations and predicted that within the next 10 years there may be 10 or 12 companies producing 150 to 200 million tons of coal. He then went on to analyze potential markets in the next 10 years and predicted that the 140,000,000 tons of coal used by the electric utility industries may well increase to 200,000,000 tons by 1960. In addition, the steel industry will be using 145,000,000 tons by 1960. The export market, Salvati said, is at its most stable point in history and will probably be with us for many years. Indications from the first quarter of this year lead to the belief that coal exports will reach 40,000,000 tons or more for 1956 and may well reach 60,000,000 tons by 1960. Total coal production will amount to about 500,000,000 tons or more this year and 600,000,000 tons by 1960. Salvati concluded by saying that in his opinion changes that have been made up to now are nothing compared to those that the industry is going to see in the next five years—and the five years following that.

Walter W. Patchell, vice-president—Research and Development, Pennsylvania Railroad Co., followed with an address on "The Railroads and the Coal Industry." Patchell pointed out that expected increases in coal production and consumption in the next few years would impose great problems on the transportation industry. He said that to transport the 175,000,000 more tons of coal a year that the railroads expect to handle in 1970 will require 118,000 more hopper cars, along with motor power equipment costing about 1.2 billion dollars at present prices. Of this, he estimated that the Pennsylvania Railroad will spend $200,000,000. He took the position that there is only one logical place to get the money for buying the additional transportation facilities, and that is from earnings on the coal side of the railroads' business, plus borrowing backed by the expected earnings from that equipment.

Representative John P. Saylor (Rep., Pa.), wound up the opening session with a warning that there is "national danger" in a mobilization program that does not include a "vigorous coal industry capable of accelerating production to meet emergency demands."

Congressman Saylor is author of the resolution which set up the current study by a House Committee to look into possibilities of an expanded research program for coal.

While expressing hope that this study will "eventually settle the industry's principal problems," Representative Saylor declared that Congress "must not relent in other undertakings necessary to ease coal's inequitable burdens." He called for legislative action to place a quota restriction on oil imports and to resolve such matters as conservation of natural gas and an increased depletion allowance for coal. The Pennsylvania Congressman invited coal executives, mining equipment manufacturers, representatives of labor organizations, and allied industry officials and labor leaders to testify at the hearings on his resolution. He recalled that the resolution authorizing the study followed recommendations of the Administration's Cabinet Committee on Fuels and mentioned that he is "not unmindful" of the assistance and support that has come from both political parties in the House of Representatives.

E. B. Agee
Chairman
Floor Committee

Luncheons Feature Widely Known Authorities

The first luncheon meeting was held on Monday, with L. C. Campbell, vice-president, Eastern Gas and Fuel Associates, and chairman of the Coal Division, American Mining Congress, presiding. The featured speaker was Philip Sporn, president, American Gas and Electric Service Co. He addressed a capacity crowd on the subject of "Sources of Energy for Electric Generation in the Next Two Decades."

The complete text of this important talk is presented on page 46 of this issue of MINING CONGRESS JOURNAL.

A second luncheon session was held Tuesday, with Guy V. Woody, Allis-Chalmers Manufacturing Co., chairman of the Manufacturers Division, American Mining Congress, presiding. "Red" Smith, sports columnist, took the mind of his audience off coal mining matters by recalling highlights from the world of sports. He reminisced about well-known and not-so-well-known sports incidents in a lighthearted manner that kept his listeners highly entertained.

Manufacturers Division Meets

On Monday afternoon, the Manufacturers Division held its regular meeting, with Guy V. Woody presiding.

Julian Conover, AMC executive vice-president, reported on the activities of the Division during the past year and plans for the future. He also reviewed briefly the legislative situation in Washington as it affects the mining industry and manufacturers of mining equipment. William E. Goodman, president, Goodman Manufacturing Co., and chairman of a special committee of the Manufacturers Division on cooperation with the Business and Defense Services Administration, presented a report on the committee's work in developing a procedure for assuring adequate amounts of critical materials for mining equipment manufacturers in the event of a future national emergency.

Guy V. Woody presided at the annual meeting of the Manufacturers Division, American Mining Congress

A nominating committee for candidates for election to the Board of Governors submitted its report and the following were elected to membership on the 24-man Board of Governors: D. E. Davidson, Link-Belt Co.; Wm. E. Goodman, Goodman Manufacturing Co.; Austin Goodyear, Hewitt-Robins, Incorporated; John Graham, American Steel & Wire Division, U. S. Steel Corp.; W. D. Moreman, Sanford Day Iron Works, Inc.; J. W. Overstreet, National Electric Coil Co.; J. T. Ryan, Jr., Mine Safety Appliances Co.; J. H. Sanford, Ohio Brass Co.; J. E. M. Wilson, Jeffrey Manufacturing Co., and Guy V. Woody, Allis-Chalmers Manufacturing Co.

At the Board of Governors meeting which immediately followed, the following officers were elected to take office in 1957: Chairman, J. E. M. Wilson, Jeffrey Manufacturing Co.; first vice-chairman, Jack H. How, Western Machinery Co.; second vice-chairman, W. L. Wearly, Joy Manufacturing Co.; third vice-chairman, A. E. Seep, Mine and Smelter Supply Co.

Special tribute was paid to a retiring member of the board, Charles B. Stainback, Westinghouse Electric Corp. Chairman Woody, in behalf of the Division, expressed appreciation for his fine efforts and cooperation over the years.

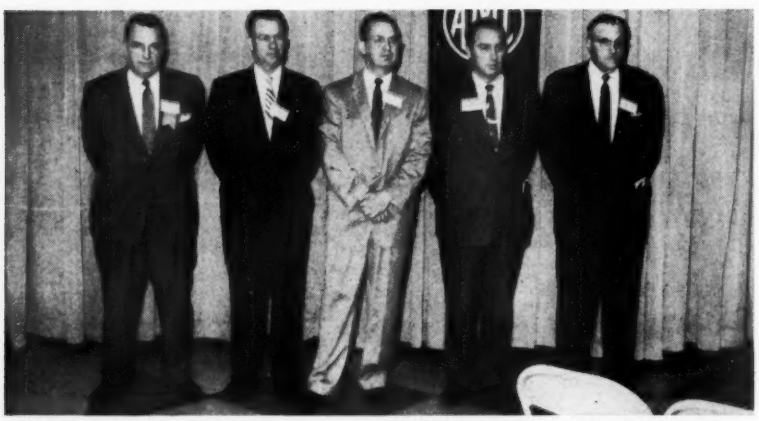
Strip Mining Sees Bigger Equipment

G. H. Utterback, secretary-treasurer, United Electric Coal Cos., was chairman of the Monday afternoon session on Strip Mining. E. R. Phelps, vice-president, operations, Pittsburg & Midway Coal Mining Co., served as floor committeeman.

The first speaker, James Hyslop, president, Hanna Coal Co., talked about the engineering development and the economics of the 60-yd shovel his company has put into operation near Cadiz, Ohio. He described the many problems involved in designing the new "super shovel" that has increased Hanna's reserves, commenting especially upon the economics involved, the stripping conditions of Hanna's properties, and the company's experience with smaller equipment.

Early performance of this new stripping shovel has met expectations. A significant fact, Hyslop said, is that no serious breakdowns have occurred and there have been no indications of design defects in any category. He concluded, "We believe that the degree of success that has been achieved in the initial operation of a prototype unit is an eloquent commentary on the merit that lies in an approach to the design of mining equipment which proceeds on the principle of the closest and fullest cooperation between manufacturer and operator.

Speakers at the Monday afternoon session on Strip Mining were, left to right: Fred Bramer, Enos Coal Mining Co.; E. R. Phelps, Pittsburg & Midway Coal Mining Co., floor committeeman; G. H. Utterback, United Electric Coal Cos., session chairman; James Hyslop, Hanna Coal Co.; A. F. Busick, Marion Power Shovel Co.; William W. Youngblood, Midland Electric Coal Corp., and W. C. Spencer, Pittsburg & Midway Coal Mining Co.



At the Wednesday afternoon session on Strip Mining speakers were, left to right: T. G. Gerow, consultant, session chairman; R. I. Richardson, Dakota Collieries Co.; A. E. Lamm, Sunnyhill Coal Co.; George D. Grayer, Bucyrus-Erie Co., and Roy M. Leseney, Truax-Traer Coal Co. Wm. C. M. Butler, Central Pennsylvania Quarry, Stripping & Construction Co., was not present at the time the photograph was taken

A. F. Busick, vice-president, Marion Power Shovel Co., showed and discussed numerous slides that indicated visually some of the features of construction of the 60-yd shovel that Mr. Hyslop had covered.

A report, "Time Study on Stripping Shovels," was delivered by William W. Youngblood, superintendent, Mine No. 2, Midland Electric Coal Corp. Youngblood commented that a time study applied to stripping shovels can be very simple and inexpensive but that results can be most gratifying. After giving an over-all picture of time studies in regard to stripping shovels, he made a few pertinent remarks on analysis of time delays, methods to increase shovel performance, and the use of a time study in planning coal production.

According to W. C. Spencer, assistant chief engineer, The Pittsburg and Midway Coal Mining Co., some of the main conditions that affect truck haulage are weather, type of pit floor, type of road material, maximum grades, and length of haul. In his talk on truck haulage with large and small units, he analyzed cost figures from records kept for two years on seven 40-ton coal haulage units. Spencer stated that the most important thing to remember when considering haulage units is that they are only one link in the production chain.

Fred Bramer, equipment superintendent, Enos Coal Mining Co., discussed haulage equipment and maintenance at his company's properties near Oakland City, Ind. He attributed the long life Enos has experienced with engines, torque converters and "torqmatic" transmission to proper maintenance of equipment. Since dust is the biggest cause for engine, torque converter and "torqmatic" transmission trouble, he emphasized that properly maintained air cleaners and well watered roads are important.

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On Wednesday afternoon T. G. Gerow, consultant, Chicago, Ill., served as chairman of the second Strip Mining session.

R. I. Richardson, executive vice-

president, Dakota Collieries Co., Division of Twin Star Industries, Inc., at Beulah, N. D., described haulage roads as constructed and maintained at Dakota Collieries lignite mines in North Dakota. He observed that main roads should be built with wide road beds and haulage roads should be constructed on natural ridges of the land insofar as possible. Entrances to pits should be one way. Richardson also commented on grades, hills, drainage, road surfaces and snow fences, mentioning some of the ideas that Dakota Collieries Co. has gained through experience on its haulage roads in all kinds of weather. The full text of his paper appeared in the April issue of the JOURNAL.

In his report, "Recent Developments in Drilling and Blasting Overburden," A. E. Lamm, executive vice-president, Sunnyhill Coal Co., described some of the latest developments on rotary drills and the trend towards larger holes with greater spacing. He also cited the many new developments in explosives such as Akremite, Nitro-Carbo-Nitrate, Unamite, and Methanite, and the marked increase in the use of Primacord throughout the industry. In concluding Lamm mentioned the problem of reducing blasting vibrations and the work being done on various types of blasting timers.

George D. Grayer, sales engineer, Bucyrus-Erie Co., in discussing this paper, commented in particular on the limiting factors in the design of rotary drills for drilling large diameter holes and the advantages of large hole drilling. In summarizing, he said that while there are definite savings in large hole drilling, the final selection of hole size must be governed by the depth of overburden, monthly yardage, and the final cost of drilling per cubic yard of material.

Maintenance of strip mining equipment was the topic of the paper by William C. M. Butler, Jr., vice-president, Central Pennsylvania Quarry, Stripping and Construction Co. He described the organization of his company's maintenance department and the duties of the various officers and workmen concerned. Butler stressed the fact that the shop superintendent and the maintenance superintendent must work hand in hand as their duties depend on each other, and the purchasing agent has to work closely with each of them. Other subjects he covered were field maintenance, shop repairs and rebuilding, and the importance of preventive maintenance.

Roy M. Leseney, mechanical superintendent, Truax-Traer Coal Co., also spoke on maintenance of strip mining equipment. He divided the subject into three parts, preventive maintenance, tools and equipment, and replacement of parts, and told what his company is doing in each case. In closing he said that Truax-Traer strives to have the necessary parts on hand and assembled ready to be installed.

Maintenance—A Must

Under the chairmanship of R. R. Williams, Jr., manager of mines, Colorado Fuel and Iron Corp., the Maintenance session was held Monday afternoon. Floor committeeman was C. E. Lowell, vice-president, Chesapeake & Ohio Railway Co.

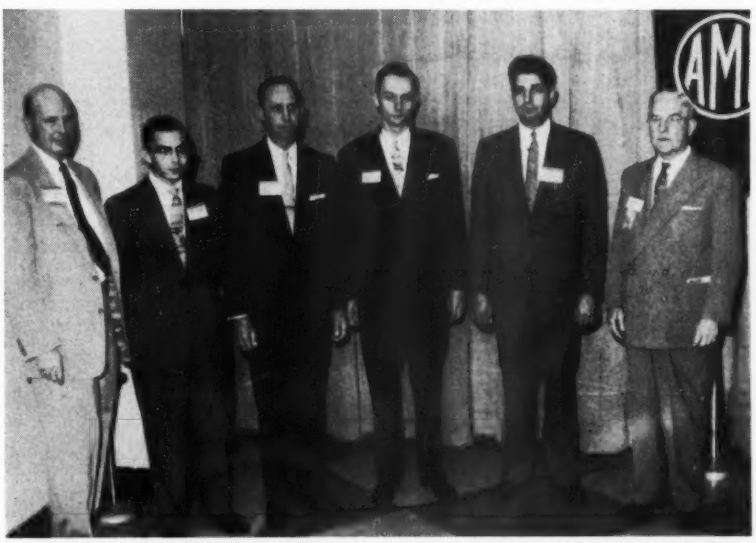
First speaker on the session was Donald B. Shupe, mine superintendent, Eastern Gas & Fuel Associates, whose address was entitled "A Modern Maintenance Organization." Shupe pointed out that breakdown time is generally the largest single factor to be reduced in order to increase coal production with existing equipment. He then described changes that were made at one West Virginia mine in his company to improve a mediocre maintenance program to the point that it was the most successful in the company. One important move was the outlining of responsibility of each maintenance employe, not only for routine maintenance but also as to lines of authority. Section repairmen were made directly responsible to the section foreman who was able to schedule spot maintenance on his machines more conveniently.

A most important step in a program of preventive maintenance, Shupe pointed out, is the regular "shopping" of each piece of major equipment for overhaul or rebuild. At the mine he described, every piece of regular machinery is put through the shop about every 12 to 14 months. Units from which maximum production is expected are not allowed to deteriorate before rebuilding. Equipment averages 100,000 to 120,000 tons between overhauls.

S. P. Carter, superintendent of maintenance, Coal Division, Armco Steel Corp., followed with a paper, "Mine Lighting Improves Safety, Production and Working Conditions." Carter described the mine lighting experiment that has been conducted by Armco over the past two years and reported favorably on the results. He concluded by saying, "Adequate mine lighting will not solve all of our safety problems because we have many accidents in which lighting is not a factor. Though it will not solve all production problems, we believe it to be a desirable working tool; a help in the prevention of accidents; an aid to increased production, and an improvement in working conditions."

Carter's paper was discussed by Robert E. Havener, electrical engineer, Mine Safety Appliances Co., who outlined suggested requirements for an effective mine lighting system. Several manufacturers, Havener said, are working to provide an approved mine lighting system and it would appear that within a short time such a system will be placed on the market.

Final paper on the maintenance ses-



Speakers at the Monday afernoon session on Maintenance were, left to right: R. R. Williams, Jr., Colorado Fuel & Iron Corp., session chairman; Donald B. Shupe, Eastern Gas & Fuel Associates; S. P. Carter Armco Steel Corp.; Robert E. Havener, Mine Safety Appliances Co.; B. R. Walburn, J. & L. Steel Corp., and C. E. Lawall, Chesapeake & Ohio Railway Co., floor committeeman

sion was presented by B. R. Walburn, general master mechanic, Vesta-Shannopin Div., J. & L. Steel Corp. Subject of his paper was "Maintenance of Ventilating and Power Conversion Equipment." Walburn also pointed out that maintenance has achieved a place of major importance in all phases of coal production. In an attempt to constantly upgrade maintenance of ventilating and power conversion equipment, J. & L. has arrived at these general conclusions: allocate specific duties to the individuals; train repairman extensively in the servicing of specific equipment; standardize equipment and buildings; schedule comprehensive preventive maintenance, and provide the proper tools and repair materials. Because the operation of the production machine is of paramount importance, J. & L. has tried to utilize all equipment in the most advantageous way with the least detriment to these machines, keeping in mind the main objective of supplying continuous service to the producing units.

Continuous Mining Grows

Sessions on Continuous Mining were held on Tuesday morning and on Wednesday afternoon. F. Earle Snarr, vice-president, Freeman Coal Mining Co., was chairman at the first session which featured case histories of mines which have had extensive experience with various types of continuous mining machines. John Boyd, consulting engineer, J. W. Woomer & Associates, was the floor committeeman.

Michael Yonko, general manager, Powhatan Mining Co., described the evolution of the present haulage system in use by Powhatan in eastern Ohio by which newly mined coal is moved away from the face to the panel entry on extensible belts. Having previously tried shuttle cars, his company found the extensible belt system brought about savings through more effective utilization of labor and elimination of delays. Yonko cited the problem of personnel resistance which had to be overcome through more effective and closer supervision. In predicting a bright future for the practice of continuous mining, he stressed the importance of maintenance to prevent costly breakdowns.

E. H. Roberts, superintendent of maintenance, presented a paper coauthored by himself and G. W. Lockin, production engineer, Inland Steel Co., describing operating experience with continuous mining machines in low coal at the company's Wheelwright, Ky., mines. He related the advantages gained through use of this equipment as well as the difficulties encountered in its introduction. Modifications and improvements had to be worked out with manufacturers to make the machine satisfactory. Roberts pointed out that more intensive personnel training and improved ventilation control are a necessity with continuous mining. Voicing optimism for the future, he revealed that Inland Steel now aims at mining seams down to 36 in. in thickness.

Robert Billings, assistant to production manager, Rochester & Pittsburgh Coal Co., discussed the use of continuous mining equipment, tracing its history from 1919 when the first machines were built to 1955 when eight percent of the nation's underground coal output — 25,000,000 tons — was mined by continuous mining methods. He pointed out the pitfalls and the mechanical "bugs" encountered in getting R & P coal mines in central Pennsylvania switched over to this equipment. Recognizing the pressure of production on mine personnel, Billings said the closest cooperation by manufacturers, managements, and operators is necessary to advance continuous mining to the point where delays caused by clean up and maintenance are eliminated.

R. N. Morris, assistant to vice-president, C. H. Mead Coal Co., Division of the North American Coal & Dock Co., related the experience of his company in southern West Virginia in using the Wilcox Miner. Although recently introduced, the machine has already demonstrated its practicability in the face of keen competition by other continuous mining machines, Morris said. Principle of the Wilcox Miner is based on the well-known short-wall cutting machine and the coal auger. This machine "rips" out the coal with twin augers, positioned hydraulicly. Morris stressed the simplicity of the operation and the low capital outlay required for the Wilcox Miner and pronounced it worthy of consideration by operators mining low seams.

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John A. Stachura, general superintendent, Enoco Collieries, Inc., was chairman at the Wednesday afternoon Continuous Mining session which featured several of the more specialized techniques of continuous mining. Floor committeeman was C. T. Hayden, vice-president, Sahara Coal Co.

Frank Williams, Jr., general manager, Peck's Run Coal Co., described his company's operations at Buckhannon, W. Va., where continuous mining is being practiced on a three-shift per day schedule in a seam varying from 54 to 72 in. thick. A crew of eight men looks after the operation of the boring type mining machine, the loader and two shuttle cars and handles all timbering, belt maintenance, ventilation and supplies. Duties of each

Addressing the Tuesday morning session on Continuous Mining were, left to right: John Boyd, J. W. Woomer & Associates, floor committeeman; F. Earle Snarr, Freeman Coal Mining Co., session chairman; R. N. Morris C. H. Mead Coal Co.; Michael Yonko, Powhatan Mining Co.; E. H. Roberts, Inland Steel Co.; Robert Billings, Rochester & Pittsburgh Coal Co., and G. W. Lockin, Inland Steel Co.

Talks at the Wednesday afternoon session on Continuous Mining were given by, left to right: C. E. McWhorter, Goodman Manufacturing Co.; J. O. Cree, West Virginia Engineering Co.; C. T. Hayden, Sahara Coal Co., floor committeeman; John A. Stachura, Enoco Collieries, Inc., session chairman; Frank Williams, Jr., Peck's Run Coal Co.; J. C. Leighton, General Electric Co., and Joseph T. Taylor, Kaiser Steel Corp.

man were described in detail. Delays and failures of all sorts were analyzed. Williams cited the difficulties encountered and what was being done to overcome some of them. Adoption of a mechanized longwall system was suggested as a possible measure to eliminate other difficulties inherent in his particular location. His report was published in the April issue of MINING CONGRESS JOURNAL.

In a discussion of Williams' paper, J. C. Leighton, of the Carboloy Department of General Electric Co., expressed the opinion that a great deal more study must be made of the possibility of the longwall system before it should be adopted. He agreed that tungsten carbide tools should be further developed but that along with improved carbides there must come improved shanks, improved design, improved holding blocks, more speed and faster feeds. He stated that it is doubtful that improved tools, machines or methods will solve the problem of sulphur or clay impurities in the coal.

Joseph T. Taylor, mining engineer, Kaiser Steel Corp., related some unique problems and their solution as encountered in a pitching 16-ft seam of coal at Sunnyside, Utah. He described the operation of continuous machines in mining entries, rooms, and recovering pillars in high coal. Roof support problems and the use of rock bolts were also described.

J. O. Cree, West Virginia Engineering Co., spoke on "Power for Continuous Mining." He presented data collected on a series of tests on all types of continuous coal mining machines, giving tabulations of the test results. He then analyzed the economics of all the machines tested and their adaptabilities under special conditions.

In discussing Cree's paper, C. E. McWhorter, mining engineer, Goodman Manufacturing Co., pointed out the high degree of efficiency being obtained in actual power consumed to remove and load coal, as indicated by the tests. He also cited the power saving possibilities which the tests indicate can be made by keeping sharp bits on the machines. In addition, McWhorter developed a case in favor of a-c over d-c power and recommended that operators carefully weigh the potential savings which should result from the use of alternating current.

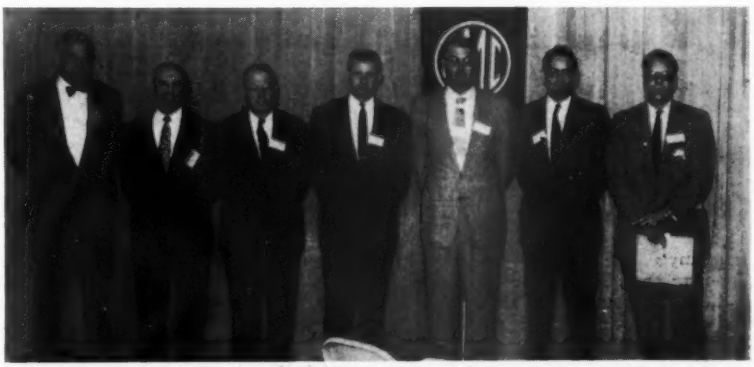
In Coal Preparation—Emphasis Is on Fine Sizes

Tuesday morning, Coal Preparation held the attention of convention goers in South Hall. W. W. Everett, vice-president, Glen Alden Corp., served as chairman of the session with Jack W. Bishop, chief chemist, Truax-Traer Coal Co., acting as floor committeeman.

First paper of the morning was given by Matthew Turkovich, director of preparation, Island Creek Coal Co., who had as his subject, "Washery Water Clarification to Prevent Stream Pollution." Turkovich described Island Creek's Bradshaw No. 6 Fine Coal Plant, which was placed in operation last November and has a capacity of 120 tph of clean cool. At the Bradshaw plant, ⅜-in. by 0, low volatile Pocahontas coal is tabled. Cleaned ⅜-in. by 28-mesh coal, after dewatering on vibrating screens, is sent to a centrifugal dryer. Underflow from the dewatering screens, the 28-mesh by 0, goes to 14-in. cyclones. Underflow from the cyclones is vacuum filtered and the vacuum filter cake is mixed with the product from the centrifugal dryer. Both are fed to flash dryers for final drying. Overflow from the 14-in. cyclones goes to 3-in. cyclones for further classification. Underflow from the smaller cyclones is also sent to the vacuum filter and the overflow is put back into the cleaning system. With this set-up about 150 gpm of fresh water is used as make-up water and about 50 gpm is bled from the tank to a settling pond, Turkovich reported.

John Griffen, Coal & Coke Consultant, Pittsburgh, Pa., discussed Turkovich's paper and briefly outlined principals and procedures that have been suggested in successfully solving water clarification problems. Griffen concluded by pointing out that the satisfactory solution of water clarification problems in bituminous coal washeries is perhaps the most uncertain element in washery design today.

The Joanne Coal Preparation Plant was described by C. C. Cornelius, vice-president of operations, Baton Coal Co. In production since September 1955, the Joanne Preparation Plant utilizes jigs to clean coarse coal and tables for minus ¼-in. coal. The ¼-in. by 28-mesh clean coal from the tables is fed to centrifugal dryers and further dried in heat dryers if so desired. The 28-mesh by 0 clean coal is sent to an 80-ft thickner. Pulp from the thickner is dewatered on a 12-disc vacuum filter. Cornelius reported that the fine coal recovery of water clarification process in the Joanne plant centers around the 80-ft thickner and the disc vacuum filter. He



Speakers at the Tuesday morning session on Coal Preparation were, left to right: W. W. Everett, Glen Alden Corp., session chairman; Matthew Turkovich, Island Creek Coal Co.; John Griffen, Coal & Coke Consultant; C. C. Cornelius, Baton Coal Co.; D. H. McFadden, Ayrshire Collieries Corp.; John Donan, consulting engineer, and Jack W. Bishop, Truax-Traer Coal Co., floor committeemen

At the Wednesday morning session on Coal Preparation speakers were, left to right: Andrew J. Gaber, United Electric Coal Cos.; R. G. Pfahler, The Berwind-White Coal Mining Co., floor committeeman; James C. Gray, U. S. Steel Corp., session chairman; H. L. Beattie, Elk River Coal & Lumber Co.; L. I. Cothern, Jewell Ridge Coal Corp., and Paul L. Richards, U. S. Steel Corp.

concluded by saying that for successful cleaning operation and maximum recovery of fine coal, where coal recovery is performed by jigs and tables, adequate water clarification is necessary to maintain a consistent marketable product.

Barge loading systems were discussed by D. H. McFadden, assistant chief engineer, Ayrshire Collieries Corp. He described the construction and operation of the Yankeetown Dock Corporation's facility near Newburgh, Ind., on the Ohio River and the Gibraltar Coal Corporation's facility near Central City, Ky., on the Green River. McFadden said that barge loading systems are chosen by considering and studying many things, the most important of which are: (1) the topography of the site; (2) the characteristics of the stream or water; (3) the specified harbor capacity; (4) the loading rate of the facility; (5) the specifications of the coal to be loaded, and (6) the prevailing weather conditions.

John Donan, consulting engineer, Madisonville, Ky., discussed variations in the types of barge loading systems described by MacFarland. He outlined the problems surmounted at the Badget Terminal, Grand Rivers, Ky., on the Tennessee River, and the new dock of the DeKoven Coal Mining Co.

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James C. Gray, vice-president, Coal Division, United States Steel Corp., was chairman of the Wednesday morning session on Coal Preparation. R. G. Pfahler, consulting engineer, The Berwind-White Coal Mining Co., acted of Floor Committeeman.

H. L. Beattie, vice-president, Elk River Coal & Lumber Co., told of his company's efforts to find ways of recovering the good coal in refuse from a cleaning plant at Widen, W. Va. The answer was found in washing refuse from the jigs in a dense-media plant. Complete cost figures on the project were given, showing that for an investment of $100,000 the net saving per year was about $544,000. Beattie described the plant layout and gave a full account of the results, including stream pollution difficulties. He pronounced the venture highly successful.

L. I. Cothern, director of engineering, Jewell Ridge Coal Corp., related the experience of his company in the recovery of coal from refuse at Tilford, Ky. Because original plans for building a custom plant for use of all operators in the district never materialized, it became necessary for each mine to have its own preparation plant. Thus, facilities were added to Jewell Ridge's cleaning plant piecemeal and had to be expanded to keep up with increased mine production. Sink-float tests were run and analyzed and it was decided to make the cut-off at 1:45 sp gr giving a maximum ash content of 10.35 percent—for which this company had a market. The equipment selected for the job included a 5 by 5-ft Western Machinery drum and a three by 16-ft Allis-Chalmers low head vibrating rinsing screen, along with sump pumps, a densifier, and a Jeffrey drum-type magnetic separator. In practice it was found that many adjustments had to be made to allow for changes in raw feed, for increased mine production, and because of changed markets. It was decided to set the specific gravity to recover a premium coal of 4.93 ash. Cost figures were presented showing the heavy media operation to be highly profitable.

The Corbin, Ky., Cleaning Plant of the Coal Division of the United States Steel Corp. was fully described in a paper authored by Paul L. Richards, manager, and Andrew E. Hamlet, superintendent. Richards presented the article which described the flow sheet in detail. The development of the plant was traced from the earliest stages of studying the various possible preparation processes, selecting the site, design and construction to the performance record attained in actual production. The three circuits of the plant, raw coal handling, coarse coal processing, and the fine coal circuit were explained completely.

The Buckheart Preparation Plant of the United Electric Coal Cos. was the subject of a report by Andrew J. Gaber, preparation engineer, who described the complete cleaning process from the raw coal to the final treatment of the small sizes. Raw coal is crushed and screened and run through dense-medium processors with varing density settings for different screen sizes. High recovery is attained on fine coal through vertically stacked launders and a six-ft hydrotator. The magnetite recovery circuit was described in detail. Performance records were presented showing the plant to be a highly satisfactory operation. This paper was published in the May issue of MINING CONGRESS JOURNAL.

Industrial Engineering, A Valuable Tool

Addressing the Tuesday afternoon session on Industrial Engineering were, left to right: John H. Gooch, Ingle Coal Co.; W. E. Hess, J. & L. Steel Corp., floor committeeman; J. Allan Brookes, Pickands Mather & Co., session chairman; H. E. Jones, Jr., Amherst Coal Co.; Ralph B. Dean, The Lorado Coal Mining Co.; John W. Straton, Princess Elkhorn Coal Co., and Walter Weaver, J. & L. Steel Corp.

A session devoted to Industrial Engineering under the chairmanship of J. Allan Brookes, General Manager, Mather Collieries, Pickands Mather & Co., covered several of the newer concepts of management engineering and their application to the coal mining industry. Wm E. Hess, manager of mines, Coal Division, Jones & Laughlin Steel Corp., served as Floor committeeman at this session.

The executive viewpoint on the topic was presented by Herbert E. Jones, Jr., executive vice-president, Amherst Coal Co. He said that a decision to establish a supervisory incentive program and develop production standards led his company into its industrial engineering program. Labor cost has been reduced 22 percent and supply cost 26 percent without the purchase of new equipment. Jones reported that this was largely due to higher efficiency with small production crews, concentrated mining, and the education of mine personnel in economy of supply usage. His paper was published in the May issue of MINING CONGRESS JOURNAL.

The operating viewpoint of industrial engineering and cost control was the subject of a report by Ralph B. Dean, administrative assistant, The Lorado Coal Mining Co. His company has approached the task of controlling total costs by breaking out each element of expense and controlling it at its point of origin. This is accomplished by establishing standards to measure performance, assigning responsibility for each element of cost, delegating authority commensurate with the responsibility, and providing financial incentive for superior performance. Time study and operation analysis are the basic tools used by Lorado's industrial engineers to set standards. Production planning and control, quality control, paper work, simplification, equipment and methods analysis, key personnel and crew balance analysis, job evaluation, a preventive maintenance system, and an orientation and job training program

have all become subjects of concentration by the industrial engineering department. Other techniques such as operations research and linear programing are currently under investigation.

John W. Straton, director of industrial engineering, Princess Elkhorn Coal Co., described the organization and operation of the industrial engineering functions in his company. He appraised industrial engineering accomplishments as entirely satisfactory at Princess Elkhorn and offered some advice on the establishment of industrial engineering in other organizations. Straton stated that the functions of the industrial engineering job must be clearly established and that the position of the industrial engineer within any organization must be determined clearly and logically. Personnel to be assigned to industrial engineering work should be carefully selected, and must be supplied the proper tools and information to effectively perform the work.

The operating viewpoint was further discussed by Walter Weaver, assistant mining industrial engineer, Vesta-Shannopin Division, Jones & Laughlin Steel Corp., in a paper which stressed a need to "put teeth" in the industrial engineering program. He pointed out the importance of the cooperation of the crew foreman in carrying out a program and means of making him familiar with industrial engineering practices. In describing the operations in his company, Weaver demonstrated the importance of cost control and careful budgeting and scheduling.

John H. Gooch, management consultant, Ingle Coal Co., concluded the program with his analysis of industrial engineering as applied to coal mining. He summed up some of the industrial engineering procedures under the heading: orderliness, creativeness, work simplification, paperwork simplification, time and motion study, budgeting executive time, cost reduction, personnel efficiency, work sampling, preventive maintenance, cost accounting, industrial psychology, incentives, training programs, and team development, stressing the fact that time is our most important asset. Gooch presented several definitions of industrial engineering which emphasized the fact that all industrial engineers should continually strive for perfection.

Roof Support—Commanding More Attention

P. L. Shields, president, Spring Canyon Coal Co., presided at the Tuesday afternoon session on Roof Support. W. J. Rude, coal manager, American Gas & Electric Service Corp., was floor committeeman.

Because of its high value and comparative scarcity, as high percentage of recovery is a must when mining coal in the Pocahontas field of West Virginia, according to H. A. Cassell, division superintendent, Pocahontas Fuel Co. In his paper, "Pillar Mining Making High Recovery," Cassell described in detail the "open end" method of pillar extraction now in general use at the Itmann mine in W. Va., which has a net recovery of 94 percent. In summarizing, he compared the open end system of mining pillars with other methods in common usage in the Pocahontas coal fields. Some of the advantages, Cassell noted, were better ventilation, less chance for squeezes and bumping, and a high percentage of recovery.

Paul Gill, chief mining engineer, Clearfield Bituminous Coal Corp., discussed the same subject. His paper dealt with mining in coal seams ranging from 34 to 42 in. thick, and outlined certain methods for the mining operations in west central Pennsylvania for the three major coal beds, namely the Upper Freeport or E, the Lower Freeport or D and the Lower Kittanning or B seams.

Four speakers representing several branches and fields of the coal mining industry gave an over-all discussion on methods and advantages of roof bolting in the symposium on roof support. The first speaker, Robert Fletcher, vice-president, J. H. Fletcher & Co., talked on roof bolting machines. He commented on the fact that the art of roof bolting has been accepted by the coal industry with greater rapidity than any other mining change since the inception of mechanization. He went on to recall the many improvements that have been made in pneumatic and rotary equipment during the past six years and to describe some of the latest drills. He also briefly discussed steels and bits.

"Roof Bolting Practices and Experiences at Jenkins, Ky.," was the subject of the next paper, given by M. E. Prunty, safety director, Consolidated Coal Co., Division of Pittsburgh Consolidation Coal Co. At present rotary drilling is practiced and both wet and dry methods of allaying dust at its source are used. Prunty listed the many advantages of roof bolting, but warned that this system was not the final answer and that a great deal of work still needs to be done in order to reduce roof-fall accidents.

While roof bolting has played its part in the downward trend of roof-fall injury-frequency rates, its influence on the over-all roof-fall injury picture of 1955 was disappointing when one considers that the use of bolts in coal mines increased by one third during 1955, according to Edward Thomas, mining engineer (Roof Control), U. S. Bureau of Mines. In discussing bolting for safety, Thomas observed that if further reductions are to be made on roof-fall injuries, the place to begin is in the "danger zone" within 25 ft of the face, where about 75 percent of the accidents occur. Further, he suggested that the way to attack the problem is first to reduce the distances between the permanent supports and the face, then use safety posts or jacks in the space between the permanent supports and the face, and finally eliminate, or at least minimize, the exposure caused by unneccessary roof testing.

The last speaker of the symposium was William J. McCullough, safety director, Snow Hill Coal Corp. In discussing the advantages of roof bolting over conventional timbering at the Green Valley Mine of the Snow Hill Coal Corp., he pointed out that roof bolting has not only resulted in reducing accidents and operating costs, but has been the difference between operating and failure for

Speakers at the Tuesday afternoon session on Roof Support were, left to right: P. L. Shields, Spring Canyon Coal Co., session chairman; H. A. Cassell, Pocahontas Fuel Co.; Jack Pero, Pocahontas Fuel Co.; Paul Gill, Clearfield Bituminous Coal Corp.; Robert Fletcher, J. H. Fletcher & Co.; M. E. Prunty, Consolidation Coal Co. (Ky.); Edward Thomas, U. S. Bureau of Mines; William J. McCullough, Snow Hill Coal Corp., and W. J. Rude, American Gas & Electric Service Corp., floor committeeman

this coal mine. He presented figures that illustrated the results of this mine's bolting program. An indication of the Green Valley Mine's faith in its roof control system is shown by the fact that a total of 353,911 bolts were installed during the year of 1955.

Haulage and Power, Twin Lifelines

On Wednesday morning the Haulage and Power Session was held under the chairmanship of V. D. Picklesimer, vice-president, South East Coal Co. Floor Committeeman was Stanlee Hampton, president, Tennessee Consolidation Coal Co.

First speaker of the morning was J. L. Thornton, manager, coal division, Belting Sales Department, Goodyear Tire & Rubber Co., who discussed "Fire Resistant Conveyor Belting Construction." Thornton pointed out that a fire resistant belt is one that meets the requirements of the U. S. Bureau of Mines, Schedule 28, which was approved last November. Fire resistant belting still uses flammable fabric, but it is so thoroughly impregnated with fire resistant materials that it can not support combustion. He described the two main types of fire resistant belting material, Neoprene, and PVC or polyvinyl chloride. Belt manufacturers in the United States lean towards Neoprene while those in England are using PVC.

Speakers at the Wednesday morning session on Haulage and Power were, left to right: V. D. Picklesimer, South East Coal Co., session chairman; J. L. Thornton, Goodyear Tire & Rubber Co.; J. H. Nash, Ensign Electric & Manufacturing Co.; S. P. Polack, U. S. Bureau of Mines; W. R. Morton, General Electric Co.; F. R. Sell, West Penn Power Co.; C. B. Peck, Jr., Anaconda Wire & Cable Co., and Stanlee Hampton, Tennessee Consolidation Coal Co., floor committeeman

J. H. Nash, electrical engineer, Ensign Electric & Manufacturing Co., was the next speaker. His topic was "Electrical Protective Devices for Belt Conveyors." In an automatic belt conveyor haulage system a large percentage of the equipment is operated unattended, Nash said, so that a small failure, mechanical or electrical, can very quickly start a fire or cause serious belt damage unless the conveyors are protected by adequate automatic protective devices. He then outlined methods of controlled sequence starting, belt slippage protection, and emergency controls along the conveyor line. Nash concluded by saying that when belt conveyors are equipped with full magnetic motor starters, sequence controlling switches, centrifugal switches and timers, they become a very effective and safe means of transporting coal.

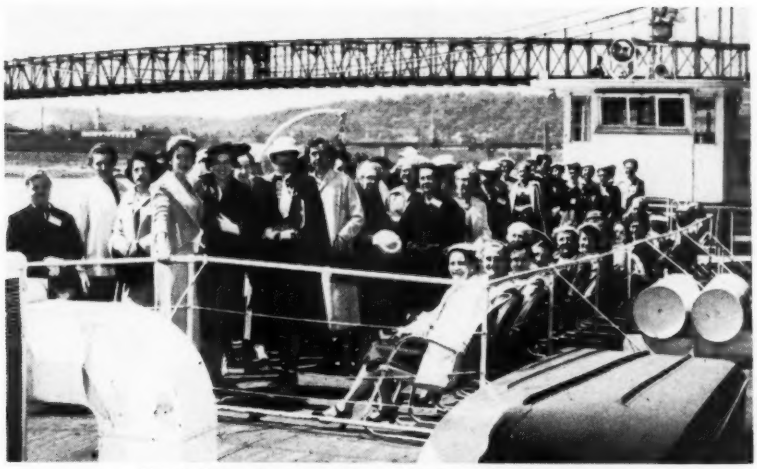
The general topic of conveyor belts was rounded out by S. P. Polack, health and safety engineer, U. S. Bureau of Mines, whose paper was titled "Prevention of Underground Conveyor-Belt Fires." After outlining Bureau tests for fire-resistant conveyor belts, Polack stressed that the availability of fire-fighting equipment, its adaptability to the type of fire, and its readiness for use can spell the difference between misfortune and disaster. He then went on to describe ways and means to protect conveyors from fire, and concluded by saying, "It appears evident that the proper installation operation, maintenance, and inspection of belt conveyors and their appurtenances will lead to a reduction in the fire hazard."

The next topic of the session was "Automation in Mine Haulage," which was covered by W. R. Morton, application engineer-Mining, General Electric Co. Morton's paper appeared in full in the May issue of the JOURNAL. It outlined the extent to which automation has already been applied in the coal industry, and describes ways in which mine haulage systems can be made more automatic.

The Haulage and Power session was concluded by a paper and a discussion on "Trends in Underground Power." F. R. Sell, senior industrial power engineer, West Penn Power Co., presented the paper. With most economists agreeing that the coal industry will be called upon to produce at least 100,000,000 additional tons of coal per year by 1965, Sell discussed just what such an expansion will mean in mine power distribution systems. He said the mercury arc rectifier because of its high efficiency and low maintenance cost, is receiving almost universal acceptance, and that the trend in this equipment is toward 500-kw units with some companies now purchasing 750-kw units. With the trend towards high concentration in mining, the burdens on the underground power supply are increasing. He cited an example where on one face entry there are peaks of 2000 amps representing loads in excess of 1000 kw at 550v. There is a great interest in a-c power for coal mines, brought about, primarily, by the rapidly increasing sizes in mining equipment and the growing need for large amounts of electricity to power this equipment.

Whether a-c, d-c or some combination of both will power the coal mine of the future, will depend upon how well each system can fill the fundamental requirements. Distribution systems in the future, however, will be required to serve mining machines with increased hp ratings and larger electrical load concentrations with greater flexibility and more reliability than ever before, Sell concluded.

C. B. Peck, Jr., manager, Industrial Sales, Anaconda Wire and Cable Co., discussed Sell's paper from the point of view of the electrical cable manufacturer. He said that increasing voltages on primary circuits offer no problem to the mine power cable manufacturers, but pointed out that with higher voltages more care must be used in splicing. This is particularly true of 15,000-v cables, and in some cases it may be advisable to use pothead terminations. With increased voltages on face equipment, however, the problem of handling larger trailing cables becomes more pronounced. The use of aluminum in trailing cables is discounted, since aluminum has only 70 percent of the current carrying capacity of copper and must therefore be larger than one made of copper to carry a given amount of current. On bare feeders which commonly parallel trolley wires, Peck said, the story in aluminum is entirely different. Here there is a tremendous saving in cost and aluminum is considered by far the most economical.



The ladies enjoyed a ride up the beautiful Ohio River

Land and Water Use Meeting

A joint meeting of the Land and Water Use Committees of the American Mining Congress and the National Coal Association was held on Wednesday. Here a full agenda was disposed of as members of both organizations discussed the problems of land use, water and air pollution and related problems in connection with all branches of the mining industry.

Fun for All

The lighter side of the convention was not neglected. In addition to the many scheduled and impromptu gatherings that play so important a part in making any convention a success, the week was highlighted by three big evening events.

On Monday evening mining men and their ladies gathered for the traditional Coal Miners Party in the Topper Club of Cincinnati's famous Music Hall. It had been quite some time since the American Mining Congress had been in Music Hall, and the return visit brought many nostalgic memories to mind of Coal Shows held here before the exhibition facilities were outgrown. A social hour was held before the guests were seated for a fine dinner and an evening of dancing and outstanding entertainment.

Tuesday night was once again baseball night, with the Cincinnati Redlegs going down to defeat in a close game with the New York Giants. The Mining Congress section was well filled and those who went out to the ball park saw major league baseball at its best.

The annual banquet on Wednesday night served as a fitting climax to the convention. G. A. Shoemaker briefly introduced industry leaders who were seated at the head table. A sparkling entertainment program followed, featuring Arthur Lee Simpkins, the young tenor who has become an all-time favorite with American Mining Congress groups.

Ladies Enjoyed It Too

While their men were busy attending convention sessions, the ladies were kept busy in the daytime with a special program. At a welcoming luncheon in their honor on Monday, in the beautiful Rookwood Room at the Hotel Sinton, they were treated to something different in style shows. "Gumption, Grooming and Glamour" was the title of this affair, a fashion program in an original pattern.

Cool and threatening weather cleared away in time to make the boat trip on Tuesday most enjoyable. A restful cruise on the colorful Ohio River included a buffet luncheon. It is no surprise that a few mining men even tried to sign up for this excursion.

On Wednesday a luncheon at the attractive Summit Hills Country Club in Kentucky was featured. On the trip through the Kentucky countryside from downtown Cincinnati a stop was made for a tour through St. Mary's Cathedral in Covington. St. Mary's, one of the most beautiful and interesting churches in the country, includes a number of Frank Duvenek's original paintings among its attractions.

Next Year

Another American Mining Congress Coal Convention has ended. As those who attended returned to the mines to put into effect the new ideas learned during the three-day meeting, plans were already being made for the giant Coal Show to be held in the Cleveland Public Auditorium May 13-16, 1957. All indications point to a record Exposition, and work will soon start on assembling another fine technical program. Coal mining has never stood still, and at the rate new ideas and equipment are being introduced to the industry, the 1957 Coal Show will be a "must" for those who produce the fuel that powers the nation's progress.

G. A. Shoemaker introduced distinguished guests at the Annual Banquet

Good fragmentation depends upon proper drilling and blasting and constitutes one of the critical factors in attaining an economical pit operation in extremely hard massive formations

Jet Piercing in Taconite

The Oliver Iron Mining Division of U. S. Steel Has Found Jet Piercing to Be the Best Method of Drilling the Hard Massive Taconite at Pilotac

By I. H. RUBOW

Superintendent,
Pilotac Mine
Mountain Iron, Minn.

THE Mesabi Range is located in Minnesota approximately 65 miles north of the city of Duluth and runs in a more or less northeasterly direction for a distance of over 100 miles. It consists of a line of hills ranging in elevation from 1400 to 1900 ft above sea level composed of granites, greenstones, slates, greywacke and green schists. To the south and gently dipping to the southeast is a series of sedimentary rocks with a middle member known as the Biwabik Iron Formation. The outcrop of this iron formation is known as the Mesabi Iron Range.

The middle member was formed during a period of deposition when an enormous quantity of iron occurring in the form of ferrous silicate ($FeSiO_3$) as coarse and minute particles or granules of the mineral greenlite, was precipitated out of solution. After the sediments had been deposited and compacted, earth movements raised them above sea level where they were exposed to erosive action. In addition, where the earth movements cracked the brittle iron formation extensively, waters carrying carbon dioxide entered and leached out the silica leaving high grade hematite ore, which has been mined since 1890. Indeed, the hematite ore bodies appear more or less like raisins in the large taconite cake.

With the granites as a base and the quartzite layer above, the Biwabik Iron Formation has four distinct horizons (see accompanying diagram), with the lower cherty on the bottom, and in sequence, the lower slaty, upper cherty, and upper slaty horizons. The Virginia slates are a younger formation and do not belong to the Biwabik Iron Formation. Glacial drift is prevalent throughout the area as a capping.

New Source of Iron

As the higher grade ores are used, a new source of iron must be found; consequently, much work is being done on the low-grade taconite. It occurs in areas on the range where the Biwabik Iron Formation remained as a solid mass, with little or no cracks to form leaching channels. The Oliver Iron Mining Division of U. S. Steel is pioneering an area such as this near Mt. Iron, Minn., called Pilotac, and is mining and extracting the minute particles of magnetite from the hard dense massive taconite. Taconite is a loose term referring to any low grade iron bearing rock that is not commercial or merchantable.

This article will deal only with the taconite of the Lower Cherty Horizon which is composed mainly of chert or quartz, and minute particles of magnetite, and is located directly above the Pokegama Quartzite.

Jet Piercing Tried

Back in 1922 the first commercial attempt to mine taconite for beneficiation failed for several reasons—one of which was the inability to drill the hard, dense, massive rock at a reasonable cost.

The purpose of the Pilotac mine is to provide sized ore or rock for the crusher at a minimum cost. At the same time it provides a splendid

opportunity to experiment and test all types of equipment that seem feasible for the job at hand. It will take three tons of taconite to make one ton of concentrate; consequently, the tonnages involved are large.

Since 1952 the mine has been testing several types of drilling equipment with some good results. Since August of 1954 it has been using the Jet Pierce Drill which brought with it a revolutionary method of drilling for blasting purposes. One of the features of the jet drill is that the bit never gets dull. Another is that hole sizes are flexible and shaped holes are possible.

Jet piercing is a process for making blast holes in hard dense rock using a high velocity, high temperature flame which causes the rock to spall or flake due to thermally induced stresses. The process fluids used are fuel oil, gaseous oxygen, and water.

A specially designed rocket type burner thermodynamically similar to the rockets developed for military purposes is the key to the process. The combustion of fuel oil with gaseous oxygen pressures of over 100 psi produce a temperature of approximately 4300 degrees F. The expansion of the hot combustion gases through the three port standard burner produce supersonic velocities of about 6000 fps.

The flame jets playing on the rock causes a thin surface layer to expand and flake away due to the thermal differential developed on the comparatively flat surface of the rock wall. R. B. Sosman, in his book on *The Properties of Silica*, refers to the phenomenon by saying an 0.82 percent volume change results from the A to B quartz inversion at 1066 degrees F. This is applicable to chert and quartz. Best results are obtained when quartz or chert is present as a finely disseminated matrix in the dense massive rock.

Water in the process performs several functions. Water serves as a coolant to keep the burner and blowpipe from melting, as a media to carry or eject the cuttings from the hole when flashed to steam at the bottom of the hole and mixed with the combustion gases. It also serves to quench and embrittle any fused material as the water is discharged from the burner tip near the bottom of the hole; thereby making it possible for the fused material to be broken to ejection size by the rotating reamer blades.

Description of Drill

The Linde Piercing Drill is a self-propelled, electrically operated machine with a comfortable cab mounted on caterpillar treads and a 70-ft mast supporting a drill rod which is called the kelly or blowpipe and is actuated by means of a winch and rotary table. Hydraulic jacks serve to level the rig prior to starting a hole.

Process fluids, after being metered in the cab, are transported through hose lines and enter the blowpipe by means of a swivel joint on the top end of the blowpipe.

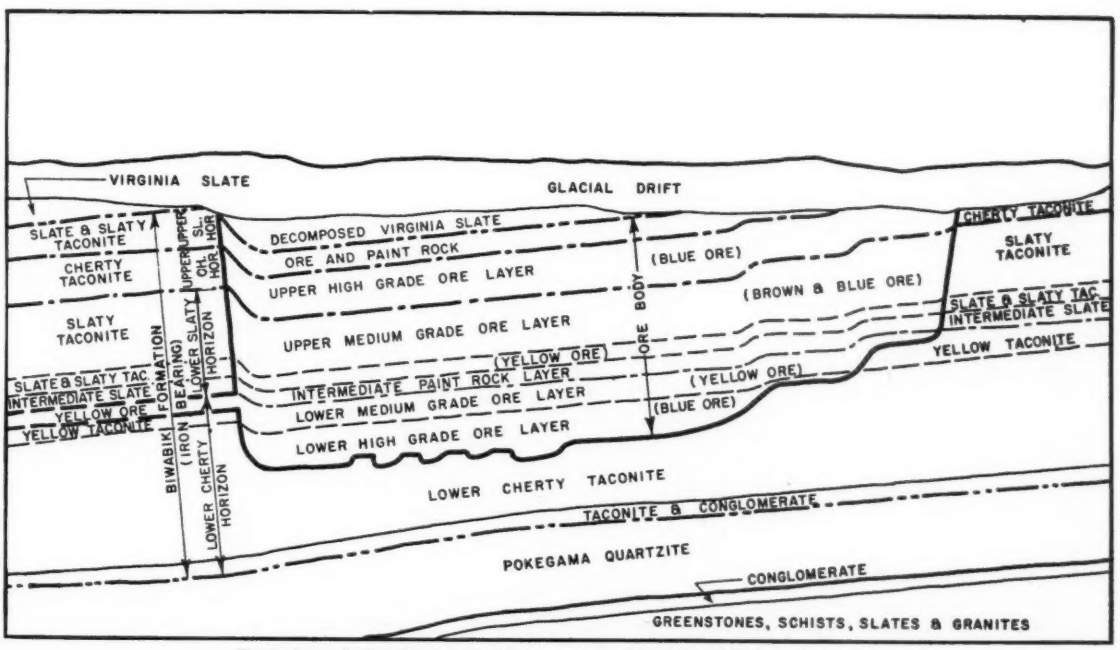
The blowpipe is a hollow rod inside of which are two silicon copper alloy tubes conducting fuel oil and oxygen separately to mix at the tip of the fuel injector. Water takes up the remaining space in the blowpipe.

About the Author

Irving H. Rubow is superintendent of Mountain Iron Mines for the Oliver Iron Mining Division of U. S. Steel Corp. He has been with the company since shortly after graduating from the University of Wisconsin in 1937, serving as engineer, pit foreman, and superintendent. His background and position as superintendent of the Pilotac project make Mr. Rubow particularly well-qualified to write this article on jet-piercing in taconite.

At the lower end of the blowpipe or kelly is the burner assembly which consists of a kelly extension, header, fuel injector, burner, and reamer.

The header is a permanent part bolted to the bottom of the kelly onto which the fuel injector and burner are screwed. The fuel oil is atomized by kinetic impact of the gaseous oxygen as it enters the rear end of the combustion chamber. The mixed gases



Typical ore body showing derivation of ores from Biwabik Iron Formation

are exhausted through a three port standard burner to produce the piercing jets or flames. The burner is ignited by an acetylene pilot light located on the lower side of the rotary table and actuated by the operator inside the cab. Oxygen and fuel oil flow at a fixed rate of 10,000 cu ft per hr and 37.7 gal per hr, respectively, and 1000 gal per hr of water is needed. These flows have been fixed through past experience. The burner, in effect, is the production unit of the machine; consequently, how well the burner assembly functions will determine its efficiency.

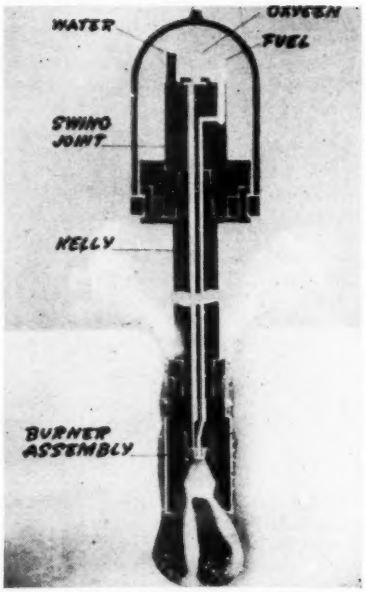
The hole sizer or reamer serves also as a water jacket and covers the header, fuel injector and burner. It is made of heavy steel tubing with six longitudinally welded, hard surfaced, steel ribs evenly spaced on the outside surface. The reamers are resurfaced with hard facing when the 6½-in. gage is lost. In other words, the reamer determines the minimum size of the corrugated blast hole. In addition, the reamer, which extends approximately ¾ in. below the bottom of the burner, protects the burner from being skarfed on the bottom of the hole.

Instruments and Controls

In operation, the complete control or efficiency, at present, is in control of the operator. The crew consists of one operator and one helper. Since the consumption of process fluids is fixed on an hourly piercing or burning time basis, the production divisor or ft per shift drilled determines the cost per ft.

From the main control panel in the operator's pulpit, the operator is able to initiate flow of process fluids, ignite the burner, control the rotation, and regulate the feeding of the blowpipe into the blast hole.

The operator adjusts the rate of feed of the blowpipe as piercing progresses. To meet conditions which cause variations in the rate of penetration — such as backbreak, cracks and fissures, poorly spallable concentrated ore bands, or fused materials— the operator adjusts the rate of blowpipe feed. To assist him in determining conditions present at the bottom of the hole, instruments are provided on the control panel to indicate variations in rotational torque, changes in cable tension which might indicate constrictions or drag in the hole, and a depth indicator informing him of the exact location of the burner in relation to the surface. A piercing rheostat, calibrated to show rate of penetration in in. per min, is provided to permit the operator to adjust the piercing rate to meet the conditions indicated by the aforementioned instruments — the rotational torque meter, the depth indicator, and cable tension meter. An automatic retraction device is provided to retract or reposition the burner as constrictions are encountered at the bottom of the hole. This device is energized through a limit switch actuated by slakening of the cable tension. Optimum location of the burner above the bottom of the hole is about four in. for maximum piercing efficiency and the retraction device is set accordingly.



Cross section of blowpipe and burner

Fumes and steam generated during the piercing operation are exhausted through a 20-in. diam stack by means of a 10,000 cfm exhauster located on the machine.

Short sections of casing pipe are installed to prevent raveling at the collar of the hole and to prevent backwash of the cuttings which accumulate around the hole.

Contourometer

The blast holes made by jet piercing are irregular in shape, varying in size from the reaming shell diameter of 6½ to 13 in., with an average diameter of approximately 8.6 in. A cross-section of a hole looks like a series of hour glasses placed one on top of the other.

The average hole depth at Pilotac is approximately 40 ft. General practice is to pierce the hole to the desired depth and make a succeeding or second pass at a predetermined rate of speed, usually six in. per min, on the bottom four to six ft of the bore hole to enlarge or expand this part to accommodate the required explosives. Chambers averaging 19 in. diam have been made by making several passes at three in. per min on the bottom of the hole.

In the conventional 10.6 in. chamber the load density or load factor of explosive per ft of hole amounts to 47.7 lbs.

To measure the volume of rock removed from the bore hole, the manufacturer, Linde Air Products, has also designed a device called the contourometer. The contourometer is an electromechanical three-fingered caliper. The three-fingered caliper expands in the hole and measures the minimum diameter through mechanical linkage. Through an electrical pickup from the mechanical linkage a direct diameter reading is registered on the dial of the meter at the collar of the hole. Past experience shows that a fairly accurate volume calculation can be made from the data when a 15 percent plus correction factor is used. The correction factor was arrived at through many field checks.

Oxygen and Water Supply

In 1954 a portable water unit and a portable oxygen storage unit were designed that would make drilling an


The jet piercing drill brought with it a revolutionary method of drilling for blasting purposes

independent function with no interference from the other phases of the operation. Since Pilotac has freezing temperatures for approximately six months of the year and sub-zero weather is common for approximately three months, water supply presents no little problem.

The water storage unit consists of a 6000-gal insulated tank with electric immersion heater coils to keep the water from freezing, a pump to furnish water for the 150-gal surge tank on the drill, with suitable connections and valves for distribution, mounted on an Athey wagon base.

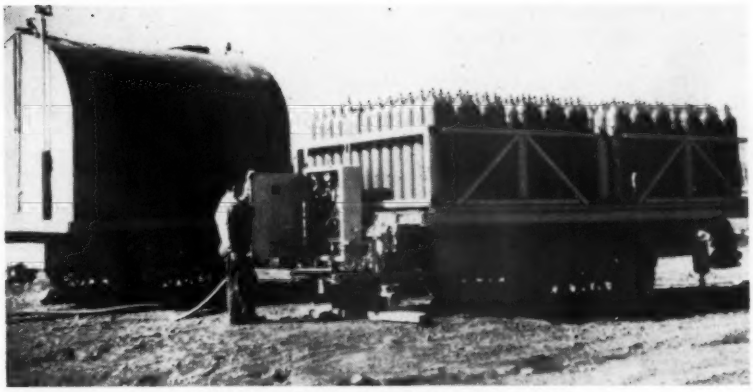
The oxygen storage unit consists of two banks of 150K cylinders each or a total of 300 cylinders which have a combined capacity of 83,500 cu ft of gaseous oxygen and a usable capacity of 72,300 cu ft, enough for 7.2 hr of burning time. Adjacent rows of cylinders are connected to a common cylinder manifold and the manifolds are joined to form two banks of cylinders. The cylinders are set on expanded grating, held together with frames and tie rods, and mounted on the base of an Athey wagon.

The enclosed control panel with the necessary valves, regulators, and gages is mounted on the frame of the Athey wagon and connected to the cylinder group.

Both water and oxygen are transferred from the wagons to the drill by means of suitable hoses 300 ft long, which allow for a drilling radius of the same length without moving the supply units.

Both units can be pulled by a tractor when necessary.

Recharging is accomplished by means of a mobile oxygen pumping unit with a vented, vacuum, insulated tank carrying liquid oxygen and provided with pumping equipment up to 300 psi. The liquid oxygen is converted to gaseous oxygen by means of a heat exchanger.



Portable oxygen and water supply wagons

Water is supplied by means of an off-the-highway tank truck.

Prior to the introduction of the portable supply system, water and oxygen were supplied by means of permanent installations long distances from the work area. Water lines were installed below the frost line in overburden on the mine perimeter. Insulated pipe from convenient outlets carried the water to the drill.

Oxygen was piped from a permanent cascade unit using surface installations very similar to the water distribution.

Since the taconite mine may some day be several miles long and probably one half to one mile wide, with a depth of several hundred feet, a permanent installation becomes impractical at best. The problems of maintenance, freezing, line or joint breakage, losses of oxygen, and interference from the other phases of the operation multiply proportionately.

Recently, in freezing and sub-zero weather, the company achieved a burning time of approximately 70 percent for a period of one month working on a single eight-hr shift per day basis. In other words, the jet drill was burning or actually piercing better than 5.5 hours of the eight-hr shift.

The portable supply system is now becoming general practice. Oxygen losses are less than one percent whereas oxygen losses of 10 to 15 percent were common using the long permanent carrier lines. The long lines also required considerable maintenance.

Holes Column Loaded

Hole burdens and spacings, at present, are 22 by 24 ft respectively. Explosive load factors amount to 1.01 lbs of explosive per cu yd of broken rock. The locations, depths, and collar elevations of holes are accurately set by the engineers in the field and duly recorded on drill maps. It is very important in the hard dense taconite that each hole bear its proportionate share of the blast.

Explosive loads are calculated and recorded for each hole and the distribution of explosives is made accordingly. Suitable primers, six-in. cans or cartridges and waterproof pellets are used in loading. Holes are column loaded. The pellets, having a specific density of 1.5, are used to fill the anular space around the cartridges in the chambered or enlarged portion of the hole. As stated before, the average load density in the chambered portion is 47.7 lbs per ft. Coarse tails, a sandy waste product from the concentrator, are used for stemming. The explosive column is carried from 12 to 14 ft below the collar of the hole, depending on conditions or requirements. Primacord with 17 millisecond connectors is used with complicated delay hook-ups.

Cost and Performance

Process fluids make up the major portion of the cost with the cost of oxygen about 50 percent of the total. However, with oxygen being sold on a sliding scale (high volume—lower unit cost) an operation of large magnitude would reduce the cost of oxygen materially. In a large operation it is conceivable that the cost of oxygen could be reduced by two-thirds.

Reading the contourometer, a device for measuring the volume of rock removed from a bore hole

A royalty based on the consumption of fuel oil is charged for use of the process.

Rates of penetration, including chambering or enlarging the lower portion of the blast hole, vary. About 10 to 15 ft per hr is possible in taconite that does not spall easily, or is badly broken, and as high as 35 ft per hr has been obtained in good spalling taconite. Although over 200 ft has been attained in one shift, the average has been just over 100 ft. Improvement has been continuous, and recently for a period of one month, the mine averaged 139 ft per shift.

Maintenance on wearing parts is relatively light. The life expectancy and necessary maintenance on wearing parts are as follows:

Reamer life—20 build-ups with 80-100 ft per build-up.

Burners—4000 ft for replaceable or bottom section with 12,000 ft for the rear or atomizer section.

Kelly extension—4 build-ups with 5000 ft per build-up.

Blowpipe—10,000 ft on an end before rebuilding by electric arc with hard facing. Number of build-ups are not known at present.

Exhaust fan rotor—Replacement of blades is necessary at approximately 12,000 ft of hole.

Pellets are used to fill the annular space around the cartridge in the chambered portion of the hole

The jet pierce drill, with its series of interlocks and warning devices, with its comfortable cab and accessory equipment designed for safe practice, is as safe as an ordinary welding torch and the precautions to be taken are approximately the same.

In the extremely hard massive taconite the Pilotac mine has found no drill that can compete satisfactorily with the jet pierce machine; however, in softer, partially altered taconite other drills have performed as well or better on a cost per ft basis.

Geology of Hercules Mine

(*Continued from page* 45)

of iron. In the lower levels, it has been noted that galena occurs in the vein in quite irregular masses more or less parallel to the walls of the vein. The combination of all these minerals has produced a dense, hard vein.

Relatively Rare Minerals

Of particular interest is the occurence of biotite. Early mapping of the vein included such notes as "thoroughly pulverized or crushed country rock" within the limits of the vein. This material was too fine grained to identify magascopically, but has a characteristic green color even when sheared and gougy. Dr. Stringham determined that this material was biotite. Through the microscope it appears as a very fine-grained mat, not unlike sericite, and might be regarded as the textural equivalent of sericite.

Another relatively rare mineral deserving mention is plattnerite, PB O_2, which was found in the oxidized portion of the vein which extended to the No. 4 adit. Plattnerite is a heavy, black mineral with a hardness of 5.5 on the Moh scale, occurring in mammillary masses.

Transition Zone

A mineralogical transition zone cuts through the lower part of the stoped area separating pyrite above from pyrrhotite below. Within 100 ft of this line both of the iron sulfides occur. The same zone, in a more general way, separates siderite as a major gangue mineral above, from grunerite as the major gangue mineral below. Siderite and grunerite occur throughout the mine, but in aproximately reverse proportions on opposite sides of the transition zone.

An envelope of iron-bearing minerals rims the commercial portion of the deposit below the No. 5 adit. The upper adits are inaccessible, but the envelope probably exists there, also.

Vein Model Useful

In explaining the vein model, Figure 2, a brief statement of its construction follows: A contour map of the vein was mounted on a sturdy wooden base. Nails were driven into this base along the contour lines to the proper elevation. Using sheet alumimum as fencing along fault offsets, the whole was filled with a mixture of sand, cement, and vermiculite molding the surface to the nail heads. The paper mache vein model was cast on this surface, dried, removed and mounted on the frame it now occupies. The result is a paper mache structure representing the Hercules vein and associated cross faults. The white sheet of plywood represents a vertical east-west plane being viewed from the southwest in Figure 2. The color code shows all stopes in black, and the iron envelope in grey. The hachured area at the lower left represents the Rambler orebody. The east edge of the monzonite is represented by the board at the left.

Vein fractures commonly deviate from a geometic plane and are more easily visualized with a model. For instance, the model shows similar vein shapes on opposite sides of the Hercules fault above the No. 5 adit. Figure 3 is a photograph of the model looking down the dip of the Hercules fault. Apparently dip-slip movement on the Hercules fault is more important than strike-slip movement. An old interpretation of the fault is strike-slip movement involving a "scissors" reversal of offset at the No. 4 adit.

Assuming post mineral, dip-slip movement on the Mercury fault there is the suggestion that the iron envelope in the west part of the mine may be the offset segment of the envelope projected to depth from below the main stopes. Later dip-slip movement on the Hercules fault would have truncated both orebodies producing the pattern of ore occurrence as it is known today.

The writer wishes to express his thanks and appreciation to Mr. Henry L. Day, president of Day Mines, Inc., who gave his support and encouragement to the preparation of this paper and permission for publication, and to Mr. Rollin Farmin, assistant manager, for his editorial comments.

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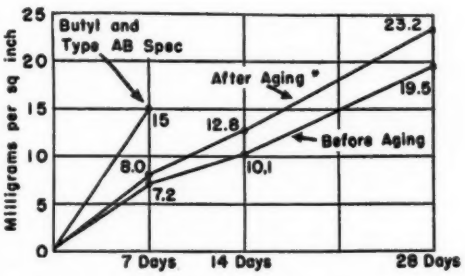

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The Aluminum Industry Turns to Coal

By Securing Top Efficiency from Coal Burning Units, Coal Can Be Kept Competitive With Other Fuels. This Is Evidenced by the Return of the Aluminum Industry to the Ohio River Valley With Its Large Reserves of Coal

By ARTHUR F. JOHNSON
Mining Engineer
Olin Mathieson Chemical Corp.

COAL is winning out in the competition with natural gas and hydro-electric power to produce lowest cost power. The fact that the aluminum industry is turning to coal is evidence of this achievement. The present success of the coal industry in the Ohio Valley in supplying coal power for aluminum is aided by favorable freight rates on raw materials and freight to market. The continued success of coal in holding and gaining new business is founded on continued improvement in coal utilization.

The aluminum industry's turn to coal is in fact a return to the use of coal. Sixty-five years ago (in 1891) in New Kensington, Pa., coal was used as a source of power to make aluminum. During the three preceding years, the first 44 tons of aluminum commercially produced by the Hall Process was made from natural gas in the city of Pittsburgh by the Pittsburgh Reduction Co. The electric power required to reduce this first tonnage of aluminum was produced by two dc generators driven by a 125 hp reciprocating steam engine fired with natural gas. In 1891, the Pittsburgh Reduction Co., moved to New Kensington where they were offered free land, cheap coal and $10,000 in cash to relocate the works. Coal was available there for 30c to 40c per ton and, therefore, natural gas was considered too expensive.

In 1956, we find history repeating itself as electric generating stations turn from natural gas and hydro-electric power to coal because coal is now less expensive. The return to coal also has a geographic significance in that the aluminum industry, after moving further and further into the wilderness during the last half a century to enjoy cheap hydro-power, is returning to the Ohio River Valley where the very successful process of reducing aluminum was originated by Charles M. Hall at Oberlin, Ohio. In February 1886, when he was only 21 years old, in the woodshed of his home, Hall invented the electrolytic reduction process bearing his name.

Search for Cheap Energy

In the interval between the 1890's and the present time, the aluminum industry in North America has searched the United States and Canada for cheap electric power. Plants have been built great distances away from raw materials and from the aluminum market center simply because cheap power in the enormous quantities needed was available elsewhere. Perhaps the question of freight costs versus power costs was not always correctly evaluated.

During the last half century, the largest blocks of electric energy were developed from hydro-electric power, first in Niagara Falls and Massena, N. Y.; then in Arvida and Shawinigan Falls, Quebec; and later in the Tennessee Valley and the Columbia River in the Northwest; and finally in the gigantic development at Kitimat in British Columbia.

During the last decade, the aluminum industry in the United States has built power plants on the Gulf Coast using natural gas as a fuel; but the rapidly increasing price of gas has arrested its further development. Some of the war-time aluminum plants, such as those in New York City and Burlington, N. J., used public utility power based on coal-fired power plants. The coal was hauled hundreds of miles to these plants resulting in a power cost of about 5.5 mills per kwh, which was too high to produce aluminum on a competitive basis.

Before building aluminum reduction plants in peace-time years, it has been necessary for the aluminum industry to seek long time contracts for power or fuel to permit amortization of the plants. The aluminum industry is a basic industry, like steel, and plants must be amortized over a period of twenty to thirty years to justify their construction. The secret of the enormous growth of the aluminum industry has been the maintenance of a relatively low selling price in the face of enormous increase in price of competing metals. Capital costs, as well as operating costs, have been held to a minimum.

Why has it taken more than half a century for the aluminum industry to return to coal for fuel in its power plants? Certainly with coal selling at 30c to 40c a ton in 1891, it was a cheap enough fuel. One reason is that it has taken all that time for research and development on coal utilization to produce low cost electric energy in large quantities, and at a price low enough to compete with hydro-electric power plants which, for the last 20 years have been subsidized by the United States Government. It is interesting to speculate on whether the aluminum industry would have used coal for the last 65 years if technical progress in coal and steam utilization had kept pace with early water turbine development.

Firming-Up Power

The immediate reason for the aluminum industry's present rush to coal is the fact that utilities can now offer the producers firming-up power in sufficient quantities, and over a long enough period of time to allow them to amortize the huge investments at a reasonable cost per pound of aluminum. In addition, the aluminum plants can be located near the aluminum consuming center of the United States, which happens to be the Ohio River Valley. The combination of relatively low cost power and low freight to market is an attractive package. Firm power in the Ohio Valley can be made for 3.5 mills of which fixed charges constitute about one mill. When allowance for freight is made, 3.5 mill power makes cheaper metal in Ohio than 2.5 mills in Oregon or Washington.

"Firming-up power" is that power to keep a generating plant load at capacity when a steam generator is down for repairs. This time averages

about 29 days per year, or eight percent of the operating time, year in and year out. When a unit of 225,000 kw size is shut down for routine or emergency repairs, it naturally requires a strong utility system to maintain voltage at the reduction plant.

There are large utility systems in the United States which protect each other by inter-connections so that the loss of a 225,000 kw generator may only result in a temporary voltage drop of a few percent.

Some Cost Figures

The installation cost of a turbo-electric steam generating plant presently runs as low as $130 per installed kw. Amortization of fixed investment over 33 years with interest at 3¾ percent and allowing one percent for property taxes amounts to a periodic payment of 6.33c per dollar of capital invested. On the other hand, the average cost of the Columbia River power system is about $414 per installed kw. The total interest, depreciation and surplus revenues from operations in fiscal 1955 was $39,000,000, so percent gross return on $1.097 billion was 3.5 percent compared to the above 6.33c. If the United States Government increased power rates so Bonneville revenues would yield 6.33 percent, the average selling price of Bonneville power to consumers would increase from 2.4 mills to 3.74 mills. In other words, firm hydro-electric power on the Columbia River could not compete with firm coal power costing 3.5 mills without government subsidy. Tennessee Valley Authority power was sold at an average price of 4.45 mills which represents about six percent return to the government to cover depreciation and other returns in lieu of interest, taxes and profits. Does this satisfactory return at TVA compared with Bonneville represent a different government policy on federal power in the two different sections of the nation?

Atomic Energy

The two largest aluminum reduction plants in the United States are at Chalmette, La., and at Spokane, Wash. Annual capacity of these plants is respectively 200,000 and 175,000 tons of aluminum. With this high capacity, such plants realize the benefits of low overhead costs. It takes about 10 tons of coal to make a ton of aluminum; so the coal consumption of plants comparable to Chalmette and Spokane would be 2,000,000 tons of coal per year. Necessary coal reserves for a 40-year operation would be in the order of 80,000,000 tons.

With atomic energy on the horizon as a possible source of low cost power, it may seem questionable to provide for 40 years coal requirements. However, coal is used in the present power plants to concentrate fissionable isotopes to constitute suitably strong atomic fuels. At the present state of the atomic art it takes more energy, in the form of coal, to concentrate the isotopes than these will later release when used as fuel in the new atomic power plants. It would seem that first of all, atomic energy will find its economic place in locations where fuel is presently very expensive; since at this time it represents essentially highly concentrated power which can be shipped to out-of-the-way places at an insignificant cost compared with the cost of shipping other types of fuel. In any case, atomic energy must find a way to eliminate dangers to personnel in the plants and over the surrounding countryside. Federal insurance has been proposed which would be in effect a subsidy. Should any industry be subsidized to save it from the cost of damage suits by the people working in and around it?

The coal industry has successfully become competitive with hydro-electric power even in the face of government subsidies. Should it have to encounter subsidized atomic power as added competition? Would not each develop most usefully under the American system of competition?

Better Utilization of Coal

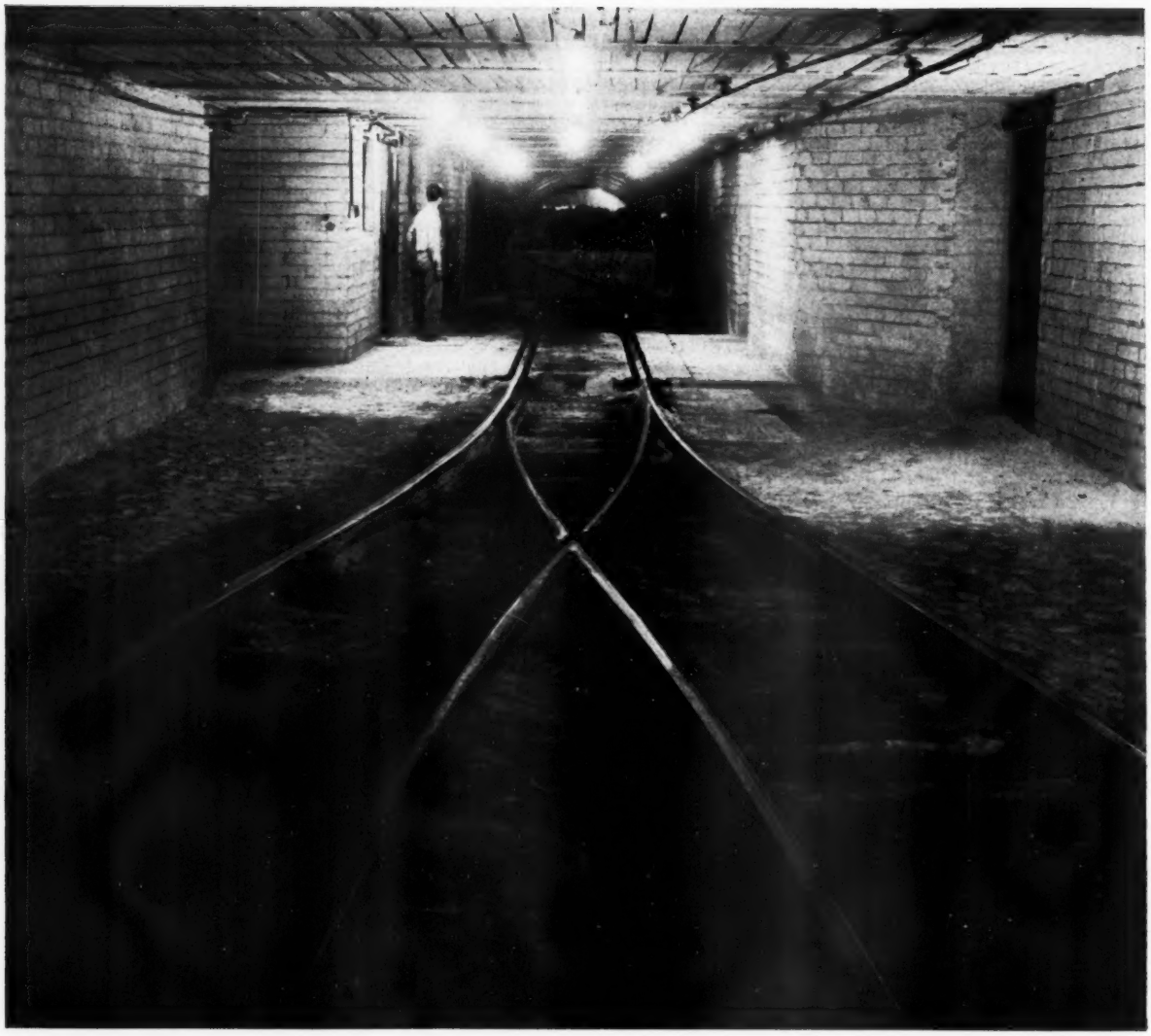
In connection with the disposal of waste products, atomic power plant advocates may well take heed of the experience in coal utilization over the years. When coal was cheap, consumers were wastrels. In 1891 when coal cost one tenth of what it costs today, it took 10 times as much to make a kwh and the unburned waste products in smoke and soot were turned loose on the public. Even today effective control is just beginning to be practiced to prevent unburned hydrocarbons from being dumped wholesale upon the public in the cities. At the same time, it can be more economic to burn fuel completely to the harmless, smokeless products of water vapor and carbon dioxide. In a few cities like Pittsburgh, public spirited men have led the way in enforcing smoke ordinances. In doing this, they have performed a service to the coal industry by requiring fuel to be burned more efficiently which results in cheaper heat units for coal customers. Coal has suffered much from adverse publicity due to smoke. Is it not time to correct this by seeing to it that coal is burned efficiently everywhere? Although combustion of coal is by no means responsible for the bulk of the smog in the cities, it will pay the coal industry to assume leadership in cleaning up this unhealthy condition.

Give credit to the aluminum industry to be vitally interested in burning fuel completely and at the best overall economy. Efforts are being made to distill the valuable tars from lignite and from coal and to burn only the resulting char. It is expected that uses can be found for by-product hydrocarbon tars so that the char (which is mostly carbon) will receive credits and so be cheaper fuel than coal. Pittsburgh Consolidation Coal Co. will produce the char for fuel at the power plant at Cresap, W. Va. operated by the American Gas & Electric Co. to produce power for the Olin Mathieson Chemical Corporation's aluminum plant.

The lesson to be learned from history is, that it is not enough for the coal producers to serve mankind by producing cheap fuel. The coal producers themselves must also be instrumental in utilizing coal completely and to the best interests of the public. Today, only 35 percent of the heat energy in coal can be converted to electric power and only 40 percent of the energy in the electric power can be utilized to make aluminum, so the over-all efficiency of transforming coal to aluminum is about 12 percent. Room for improvement in efficiency certainly still exists. Yet it is a wonderful thing that 10 lb of coal in burning can, in effect, be transformed into one lb of the metal aluminum, a metal which does not rust and so may be useful to this country for hundreds of years. A pound of aluminum may be used first as aircraft sheet and later reappear when scrapped as roofing sheet, and again as an automotive piston.

The Olin Mathieson Chemical Corp. is proud of its part in bringing the aluminum industry to power made from bituminous coal. Already Olin Mathieson has a stake in the coal industry. Through its Explosives Division it sells explosives and related products as well as the Armstrong Coalbreaker, a device which utilizes compressed air for breaking out coal in underground operations. In the years ahead, it looks forward to a part in advancing the means of utilizing coal to the highest degree. In the Kammer Plant now under construction at Cresap, W. Va., a heat rate of 9200 Btu per kwh, or less is envisaged with 99.5 percent combustion of coal or char and 94 percent recovery of ash.

Today the market for coal is improving and in the next 10 years, the utility industry is scheduled to double its coal needs. The great potential for coal lies in its better utilization. Only by securing top efficiency from coal burning units can coal be kept competitive with other fuels. The cost-conscious aluminum industry is returning to coal because equipment is now available to perform this function. Coal has recaptured the aluminum industry and is bringing its plants back to the Ohio River Valley It can capture many more industries and customers by teaching this country how to burn coal efficiently.



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Wheels of GOVERNMENT

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As Viewed by HARRY L. MOFFETT of the American Mining Congress

SENSING the possibility of adjourning by late July or early August, Congress is stepping up its legislative tempo. Many major measures, heretofore resting quietly on legislative calendars or in committees are being scheduled for early floor debate. Major legislation which may be considered in the next few weeks includes the highway construction program, a revised Social Security plan, foreign aid, U. S. membership in the Organization for Trade Cooperation, extension of the Defense Production Act, and a number of departmental and agency appropriations measures.

Other bills being readied for floor action, and which will probably be sent to the White House before adjournment, include extension of the Contract Renegotiation Act with a provision easing the rules for recapturing "excessive" defense contract profits, and continuation of the Water Pollution Control Act. A revised farm bill will also get through and may be signed by the President. The new bill, as in the case of the one previously vetoed by Mr. Eisenhower, contains a provision requiring that strategic materials received from foreign nations in exchange for surplus U. S. agricultural products must be "locked up" in a supplemental stockpile under the same conditions as minerals and other materials procured for the national defense stockpile.

While the Administration has reported that the budget surplus for the fiscal year ending June 30 will be $1.8 billion, a reduction in individual income tax rates is not favored at this session. Fiscal leaders of both parties in Congress have indicated that the surplus should be applied to reducing the huge national debt and that tax legislation should be deferred to next year.

Social Security Battle

A hot scrap is in prospect when the Senate takes up the revised version of the House-approved Social Security bill broadening coverage and liberalizing benefits. Before sending the bill to the floor the Senate Finance Committee knocked from the measure two highly controversial provisions opposed by the Administration. These would have provided social security benefits for disabled workers at age 50, a reduction of the age at which women receive benefits from 65 to 62, and a 25 percent increase in payroll taxes to finance these benefits. The Committee also rejected proposed amendments for food stamp plans and increased Federal grants to States for old age assistance.

A strong drive by advocates of increased Social Security and public assistance benefits will be made on the Senate floor to include the provisions which the Committee deleted from the bill.

OTC Drive Stalls

While the Administration is pressing for early House action on the bill to authorize United States participation in the Organization for Trade Cooperation (OTC), polls among House members indicate that not enough support can be mustered to secure passage. The House leadership is holding off action on the bill pending efforts to enlist more support for it.

The bill was approved earlier by the House Ways and Means Committee but even there a wide split was indicated by the 18-7 vote. Strong opposition has stemmed from a number of domestic industries which view it as an effort to place U. S. trade under the control of an international body. The opposition of the textile industry has stirred a number of Southern legislators to voice their disapproval of the bill.

The President, using a report by four advisors to the U. S. delegation negotiating tariff cuts with 26 nations under the General Agreement on Tariffs and Trade (GATT) as a vehicle, pressed for support of the bill. The advisers had said that adoption of OTC "would clearly be in our enlightened self-interest" and failure of the U. S. to join the organization "would cause great dismay and disappointment throughout the free world at a time the Soviet Union is stepping up its foreign economic efforts."

Meanwhile, the fourth round of tariff negotiations under GATT have been concluded and reports are that the United States has agreed to further reductions in its tariff rates. The commodities affected and the reductions made are still wrapped in secrecy.

Highway Program Advances

Chances are bright that before Congress adjourns a new Federal highway program will be placed upon the statute books. The 40,000-mile super-highway program has already been approved by the House, and the Senate Public Works Committee has acted on that portion of the bill authorizing the road net. The Senate Finance Committee has completed hearings on the financing provisions.

The Public Works Committee, in approving the program, substituted provisions of the Gore Bill, which passed the Senate last year, for the authorizing provisions of the House bill. It approved an extension of the roads program to a period of thirteen years to bring it in line with the House measure. Major difference in the two bills lies in the manner of

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Washington Highlights

SOCIAL SECURITY: Senate fight looms

OTC: Approval outlook dim

HIGHWAY PROGRAM: Congressional approval imminent

COAL RESEARCH: Hearings scheduled

OIL IMPORTS: Study requested by ODM

PHOSPHATE LEASES: Increased acreage sought

ATOMIC INSURANCE: AEC proposes plan

MINERALS PURCHASES: Program extensions probable

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apportioning funds to the various States. The Senate Committee also struck from the measure an amendment which would have required the payment of wages to construction workers at rates not less than those prevailing in the same type of work on similar construction in the immediate locality as determined by the Secretary of Labor.

A number of Western Senators oppose the substitution of the Gore bill's provisions apportioning Federal funds to the States, on the grounds that the public lands States would not receive an adequate share of funds to complete their road programs. They will probably make a determined drive to adopt the House provision apportioning funds on the basis of the needs of the States.

Testifying on the financing provisions before the Finance Committee, Treasury Secretary Humphrey endorsed the Administration's highway program which would involve expenditures of more than $50 billion over the next thirteen years. He said that the House-approved financing provisions are deficient and would require new taxes in future years.

Coal Hearings Set

A special Subcommittee of the House Interior Committee, headed by Rep. Edmundson (Dem., Okla.), will open hearings June 4 to study the possibilities of a research and development program for the U. S. coal industry.

These hearings are the result of House adoption of a resolution by Rep. Saylor (Rep., Pa.) calling for a study of such fields of research as coal production, transportation, distribution and utilization and a general appraisal of coal technology. Recommendations for any legislation believed necessary would result from the hearings.

In addition to Edmundson, the subcommittee consists of Reps. Aspinall (Dem., Colo.), Metcalf (Dem., Mont.), Udall (Dem., Ariz.), Saylor, Chenoweth (Rep., Colo.), and Dawson (Rep., Utah). The committee, in announcing the hearings, said that it will seek to determine the possibilities that exist for developing such new and expanded uses for coal through research programs as would result in "a stable and thriving coal industry." It said that it will consider such factors as mining, preparation, handling, marketing, distribution, transportation, conventional uses, combustion, hydrogenation, carbonization, gasification, oils and tars from coal, coal chemicals, and miscellaneous coal processes and products.

The hearings are expected to run intermittently through the adjournment of Congress and field hearings may be held thereafter. Coal industry representatives, labor organizations, trade associations, public and private research groups, and qualified individuals have been invited to testify. The American Mining Congress will appear before the Committee early in the hearings.

Meanwhile, the U. S. Bureau of Mines has issued a report listing more than 200 possibilities for research in the field of bituminous coal. The study, made in cooperation with a private industry organization, will be available to the Committee for the hearings.

Oil Imports Under Study

ODM Director Arthur Flemming has called upon the President's Advisory Committee on Energy Supplies to re-examine its formula relating to residual and crude oil imports and to file its findings by September 1. He said that if the re-examination showed that oil imports are threatening to impair the national security, he would schedule a public hearing not later than October 1 under terms of the Trade Agreements Act, to determine whether the nation's defense was being impaired by such imports.

In a letter to oil importers, Flemming warned that increases in planned imports for the second quarter are a "source of real concern." He said that if planned imports materialize it would result in an over-all excess for the first half of 1956. He told the importers that he hoped downward adjustments will be made and that the crude oil import situation for the entire year will show a satisfactory relationship to domestic production as recommended by the Advisory Committee.

With respect to residual oil imports, Flemming said that during the last nine months of 1955 they were below the figure suggested by the Advisory Committee and that planned imports for the first six months of this year were only slightly in excess of those recommended by the Committee. He stated that this small increase "may well be needed to build up stocks of residual fuel oils to levels consistant with past experience and to give assurance of meeting next winter's requirements."

Phosphate Lease Increase Sought

Hearings were held late in May by the Mines and Mining Subcommittee of the House Interior Committee on a measure which would increase to 10,240 acres the total acreage of phosphate lands that may be leased by any one company within a State. Presently, leases by any one company in a single State may only total 5,120 acres, with over-all lease holdings within the United States restricted to a total of 10,240 acres. The pending bill would make no change in the over-all limitation.

Representatives of the phosphate mining industry, including spokesmen for the American Mining Congress, testified in favor of the measure, pointing out that the larger acreage is necessary to the expansion of this important industry in the public lands States. The bill also had the support of the Interior Department and organizations representing consumers of phosphate. Opposition to the bill was voiced by two producing companies.

Present indications are that the bill may be favorably acted upon by the House Committee. In the Senate, it is expected that the Interior Committee may also stamp its approval on the measure at an early date.

Atomic Insurance Plan Proposed

The AEC has proposed that Congress enact legislation which would provide commercial concerns involved in atomic power projects with unlimited coverage against claims resulting from a major atomic accident. This coverage would apply only to losses above those which can be covered by private insurance. Private insurance companies have agreed to cover each atomic reactor with up to $65 million in liability insurance. Under the AEC proposal, the Commission would borrow $500 million from the Treasury to handle the program.

AEC Chairman Lewis Strauss presented the proposal to the Joint Commitee on Atomic Energy, stating that it is necessary to remove a "major deterrent" to the development of atomic power by private industry. Chairman Anderson (Dem., N. Mex.) of the Joint Committee expressed dissatisfaction with the plan because of its lack of protection for the public, as in the event of gross negligence.

A host of witnesses appeared before the Committee urging Federal assistance in insuring against accidents resulting from atomic power projects. These included representatives of the insurance, electric power, and coal industries. Spokesmen for the electric power industry emphasized that a legislative solution to the insurance problem is needed if the industry is to undertake to further develop atomic power. Tom Pickett, appearing for the National Coal Association, endorsed the principle of Government indemnity and urged that Congress require experimental and developmental nuclear plants constructed with Government assistance or indemnity to be built in isolated areas remote from large centers of population.

Considerable support for Federal insurance of atomic plants is becoming apparent on Capitol Hill, but what type of bill may be approved by the Joint Atomic Energy Committee

(*Continued on page* 105)

AMC Personals

Lawrence Litchfield, Jr., general manager of the mining division for the Aluminum Company of America, has been elected a vice-president of Alcoa.

Litchfield joined Alcoa in 1925 and in 1926 became acting managing director of an Alcoa subsidiary in Suriname, South America. After holding several positions with the company's bauxite mining operations, he was named president of Alcoa Mining Co. in 1952. When that company became Alcoa's mining division shortly after, he was named division general manager.

David L. Francis, president of Princess Elkhorn Coal Co., Huntington, W. Va., has been elected to a two-year term as a director of the Chamber of Commerce of the United States. Francis will represent the nation's natural resource industries. He has served on the Natural Resources Committee of the Chamber for several years.

Richard Knight has been named vice-president and director of five mining firms controlled by International Smelting & Refining Co. The companies, all with properties in Utah's Tintic District, are: Dragon Consolidated Mining Co., Empire Mines Co., Eureka Swansea Consolidated Mining Co., Middle Swansea Consolidated Mining Co., and Tintic Drain Tunnel Co.

Blue Diamond Coal Co.'s board of directors has elevated **John Mayhew** and **L. M. Rayburn** to vice-presidencies. Rayburn has been purchasing agent in charge of stores. Mayhew has been general manager of mines.

H. R. Burch was recently named assistant general manager by The Anaconda Co. at its Weed Heights, Nev., operation. **C. J. Houck** succeeds Burch as mine superintendent and **D. K. Gill** succeeds Houck as general mine foreman.

At the annual meeting of the Board of Directors of Sycamore Coal Co., **T. C. Hamill** was elected vice-president and **P. A. Pilkenton** was elected treasurer. Pilkenton still retains his duties as secretary of the Sycamore Coal Co. and subsidiaries companies.

H. E. Treichler was recently elected to the board of directors of Pan American Sulphur Co. Since 1954 Treichler has been a general consultant for Pan American Sulphur, which has developed holdings in southern Mexico.

Before his association with Pan American, Treichler was for 36 years with Texas Gulf Sulphur Co. He retired from that company as vice-president and general manager of sulphur operations.

On May 1 **John G. Jaeger** became secretary of Glen Alden Corp., and **Robert S. Knapp** became treasurer and assistant secretary.

George N. England, who had been secretary and treasurer of the firm since its organization in 1921, was named to the newly-created post of financial assistant to the president. **Carl L. Mancini** was elected assistant treasurer.

Jaeger has been connected with Glen Alden since 1931 as secretary of various subsidiaries and head of the tax department. Knapp and Mancini have been members of the treasurer's department since 1921.

It was announced recently that **Dr. Grover C. Dillman,** president of the Michigan College of Mining and Technology, Houghton, Mich., would retire from his position on October 1, 1956.

In public life for the past 41 years, Dr. Dillman became Michigan Tech's president in 1935. He joined the staff of the Michigan State College in 1913, and was State Highway Commissioner from 1929 to 1933. He has also served as director of the Welfare Department and as director of the budget for the State of Michigan.

Percy W. Galeener, superintendent at Crichton No. 4 mine, has been promoted to general superintendent of all mines in West Virginia by Johnstown Coal & Coke Co.

He was succeeded as superintendent of No. 4 mine, at Panther Gulch, W. Va., by **Louis Fyock.**

Three appointments to new positions, all effective April 1, in the manufacturing, operating and engineering divisions of Universal Atlas Cement Co. were recently announced.

Francis A. Hennigan, plant manager of the company's operation at Hannibal, Mo., was named assistant to vice-president, manufacturing, in New York. **Mike M. Henning,** assistant plant manager at Hannibal, succeeds Hennigan as plant manager. **Arthur P. Lothrop,** assistant to vice-president, manufacturing, was appointed appropriations control engineer.

Caland Ore Co., Ltd., Canadian iron ore mining subsidiary of Inland Steel Co., recently elected **A. J. Cayia** president and general manager. Cayia was vice-president and general manager. He is also president of Inland Lime and Stone Co., the steel company's limestone division.

P. D. Block, Jr., formerly president, has been elected chairman of the board of Caland, a post held until April 1 by **Clarence B. Randall.**

A. B. Foulger, vice-president and general manager of Lion Coal Co., Ogden, Utah, was elected president of Utah Coal Operators Association. He succeeds **Oscar A. Glaeser,** vice-president of United States Fuel Co. **W. J. O'Connor,** president and general manager of Independent Coal & Coke Co., was elected vice-president of the group.

A. B. Chafetz has resigned as assistant maintenance and engineering superintendent for the Potash Divi-

A. B. Chafetz

Joe G. Ivy

sion, International Minerals & Chemical Corp., to open a consulting office in Carlsbad, N. M. He has been succeeded by **Joe G. Ivy,** assistant manager, Engineering Department.

Ray A. Bennett, vice-president in charge of mining operations for the Seaboard Oil & Gas Co. of Wichita Falls, Tex., now heads the firm's new Denver offices. Seaboard's mining operations are being headquartered in Denver because of its central location to the company's recently acquired 22,000 acres of uranium mining properties in Colorado, New Mexico, Utah, and Wyoming.

Brower Dellinger has been named manager of the Monticello uranium mill, operated for the Atomic Energy Commission by National Lead Co. Dellinger replaces **Helmer Johnson**, resident manager at the mill for The Galigher Co.

Galigher Co. relinquished its cost plus fixed fee contract at the mill, effective April 1, and was replaced by National Lead.

Charles E. Lawall has been named vice-president—coal traffic and development, of the Chesapeake and Ohio Railway. Lawall has been assistant to the president—coal traffic and development, since November 1955.

Lawall, who had been president of West Virginia University, at Morgantown, for seven years, joined C&O in 1945 as engineer of coal properties. He is also chairman of the Mining Development Committee of Bituminous Coal Research Inc.

International Minerals & Chemical Corp. has announced two changes in executive personnel.

Rune E. Swanson has been appointed controller and **William Bellano** has been appointed to the newly created position of director, Mining & Minerals Exploration.

Before joining International, Swanson was assistant controller of U. S. Gypsum Co.

Bellano has been serving as production manager for International's Phosphate Chemicals Division, where his principal responsibility was the management of the company's new Bonnie phosphate chemicals plant. Creation of his new position will place increased emphasis on International's plans for the location and development of new ore deposits, on the development of existing ore bodies, and on the development of newer, low-cost mining methods, the company reported.

Benjamin F. Sutherland, an assistant U. S. district attorney for Western Virginia since 1954, has resigned, effective June 15, to become an attorney for the Clinchfield Coal Corp.

Claude W. Courand has been named general manager of Chilean operations for Cerro de Pasco Corp., with headquarters in Santiago, Chile. Courand was a member of the U. S. foreign service and counselor for economic affairs at the U. S. Embassy in Santiago before his present assignment.

Philip I. Conley has been appointed chief geologist of American Smelting and Refining Company's northwestern mining department to succeed A. O. Hall, who has resigned. Conley has been with Asarco since he was discharged from the service in 1946. In his new position he will be in charge of operating and exploration geology in the entire northwestern area, which includes from the eastern border of Montana to the northern boundary of California, and western Canada and Alaska.

Following the death of **Harry M. Moses**, the Executive Committee of the Bituminous Coal Operators' Association has elected **Daniel W. Cannon** acting executive director with all of the authority, duties and responsibility of the president until such time as a president is elected. Cannon has also been reelected secretary of the Association.

Dr. George A. Kiersch resigned as associate professor, University of Arizona geology department last summer and since has devoted most of his time to completing the Mineral Resources Survey of the Navajo country, Arizona-Utah. Dr. Kiersch has been serving as director of this project due for completion by the spring of 1956.

Henry E. Turner is now superintendent of Tams No. 2 mine of Winding Gulf Coals, Inc. He was elevated from general mine foreman to the superintendent's post. **D. Porter Hall**, formerly general assistant foreman, succeeds Turner as mine foreman, and **George Williams** has been appointed night foreman at the operation near Beckley, W. Va.

W. M. Peirce has been appointed assistant to the executive vice-president of the New Jersey Zinc Co. His principal duties will be to administer the company's patent business, including licensing.

Robert L. Hartzell has resigned his position as consulting economist with World Mining Consultants, Inc. **Cloyd M. Smith**, mining engineer, succeeds Hartzell. Smith has been a consulting engineer since 1946 and will continue to serve former clients in addition to his new duties.

R. J. Horsman has resigned as chief engineer of Day Mines Inc., to join the exploration department of The Bunker Hill Co. **Ray Giles** succeeds Horsman.

Horsman had been employed by Day Mines Inc. for 14 years. Before that he had been with Homestake Mining Co. at Lead, S. D.

Giles was previously with Day Mines from 1951 until 1954, when he resigned to go with the Wah Chang Corp.

— *Obituaries* —

Howard C. Felver, 79, identified with coal mining and construction work for the M. A. Hanna Co., died April 1 in Cleveland, Ohio.

Mr. Felver became associated with M. A. Hanna organization in 1918 and was placed in charge of construction work for the Susquehanna Collieries Co. The late 1920s and early 1930s he headed his own construction firm but returned to the Hanna interests in 1934 to organize a combustion engineering department. He headed the department until 1940, when he was transferred to St. Clairsville, Ohio, to supervise construction work at the mines of the Hanna Coal Co. He retired six years later.

Frank A. Hunter, 69, former vice-president of W. G. Duncan Coal Co., of Greenville, Ky., passed away March 28. Mr. Hunter retired from his position with the coal company in 1952 because of poor health.

Harve McKibben, 64, retired lead and zinc operator in the Tri-State area, died March 19.

Active in the Tri-State mining field since boyhood, Mr. McKibben was associated with the old Commerce Mining and Royalty Co. as mining lease manager for several years. He later was part owner of the Indian Mining and Royalty Co.

Frank Hillman, Sr., 83, Alabama coal mining man, died April 7, in Birmingham, Ala.

Mr. Hillman served five years as state mine inspector for Alabama. He also held positions as superintendent of mines and director of mining safety with several coal companies in Alabama.

Leslie I. Markel, 56, director of personnel for the American Smelting and Refining Co. in the Wallace, Idaho, district, died suddenly March 9. Mr. Markel joined the company in 1925 and had been in charge of the Arsaco personnel office at Wallace since its establishment in 1936.

J. William Knight, 81, Utah industrialist, mining executive and church leader, died March 11.

Born in 1874, Mr. Knight assisted his father in developing the Humbug Mine, one of the first gold and silver operations in the Tintic Mining District. A life member of the American Mining Congress, he was president and director of the Utah Ore Sampling Co., Knight Ideal Coal Co., Great Western Mines Co., Miller-Hill Mining Co., Tintic Central Mining Co., Ibex Gold Mining Co., North Bingham Mining Co., Bingham Empire Mining Co. and Nevada Park Keno Mining and Milling Co.

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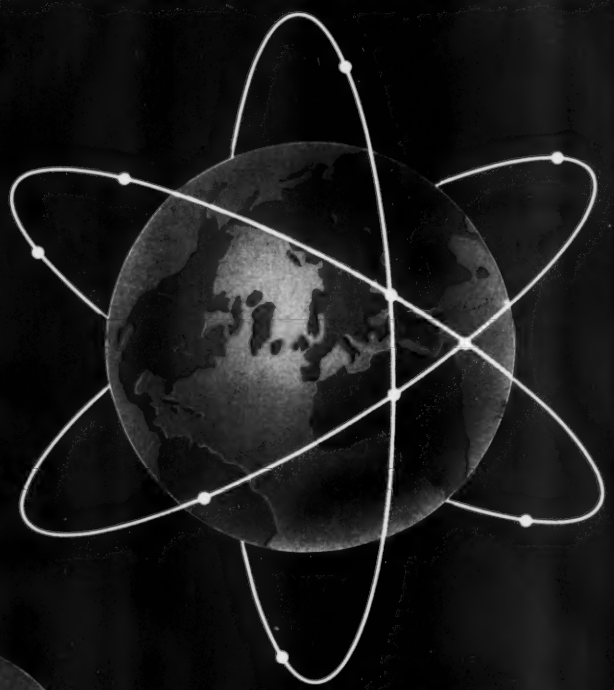

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To Build a Zirconium Mill

National Research Corp. reportedly will build a $25,000,000 plant near Pensacola, Fla., to produce zirconium. National Research, whose headquarters are at Cambridge, Mass., expects to start construction immediately, with completion scheduled for early 1958.

Gulf Coast beaches are said to have the largest deposits of zirconium in the United States.

W. Va. Coal Meetings

The annual spring meeting of the West Virginia Coal Mining Institute will be held at the Prichard Hotel in Huntington, W. Va., June 21-22. Program committee chairman is H. A. Jones, general superintendent, Carbon Fuel Co.

The Institute's autumn meeting will be held jointly with the Central Appalachian Section, AIME, November 2 and 3 at the Greenbrier Hotel, White Sulphur Springs.

River Shipments of Coal Up

Two hundred and two loading and unloading docks are now necessary to handle the rapidly growing bituminous coal trade on the Western Rivers according to The American Waterways Operators, Inc. This traffic requires 84 loading docks and 118 unloading docks.

Barges moved 70,603,702 tons of bituminous coal and lignite on the inland waterways in 1954, the latest years for which an official tabulation is available. The 1955 movement was much greater.

Three new electric power plants on the Ohio River each burn approximately four million tons of barged coal annually. One of these has a barge unloading dock more than 4000 ft long. Some of the newer docks can load two million tons of coal a year.

In the 109 miles of the Ohio River between Pittsburgh, Pa., and Powhatan Point, Ohio, there are five loading docks and 26 unloading docks. Between Powhatan Point and Maysville, Ky., (300 miles) there are ten for loading coal and seven for unloading, and between Maysville and Cairo, Ill., (571 miles) there are eight for loading and 30 for unloading.

Two recent developments in this coal trade are the movement of coal from mines on the Illinois River to industries on the shores of Lake Michigan and a new contract for barging coal from mines in Kentucky to an electric power plant in Tampa, Fla. Shipments to Tampa will total one million tons the first year. The distance from the loading docks at Uniontown, Ky., to Tampa is approximately 1600 miles.

The busiest coal port on the Western Rivers is the Port of Clairton-Elizabeth, Pa., which in 1954 handled 9,375,170 tons of coal.

The Port of Huntington, W. Va., handles more coal than any other Ohio River Port. Its 1954 tonnage was 7,323,295.

Mining Companies Seek Oil

American Metal Co., Ltd. and Cerro de Pasco Corp., large nonferrous metal mining companies owning oil interests, and J. C. Trahan, an independent drilling contractor of Shreveport, La., have formed a new company to engage in offshore oil drilling in the Gulf of Mexico.

The new corporation, Trahan Exploration, Inc., will have offices in Shreveport and New Orleans.

The exploration company is expected to take delivery of the first drilling barge this fall. The barge, being constructed to operate in water of maximum depth of 45 to 50 ft, will be 180 by 136 ft with a vertical height of 66 ft. It will be equipped with a rig capable of drilling to a depth of 18,000 ft.

Officers of Trahan Exploration are J. C. Trahan, president; Thornton Tarvin, H. Danforth Starr and John Payne, Jr., vice-presidents; Michael D. David, secretary; Hans Vogelstein, treasurer; George H. Cain, assistant secretary; and Erwin A. Weill, assistant treasurer.

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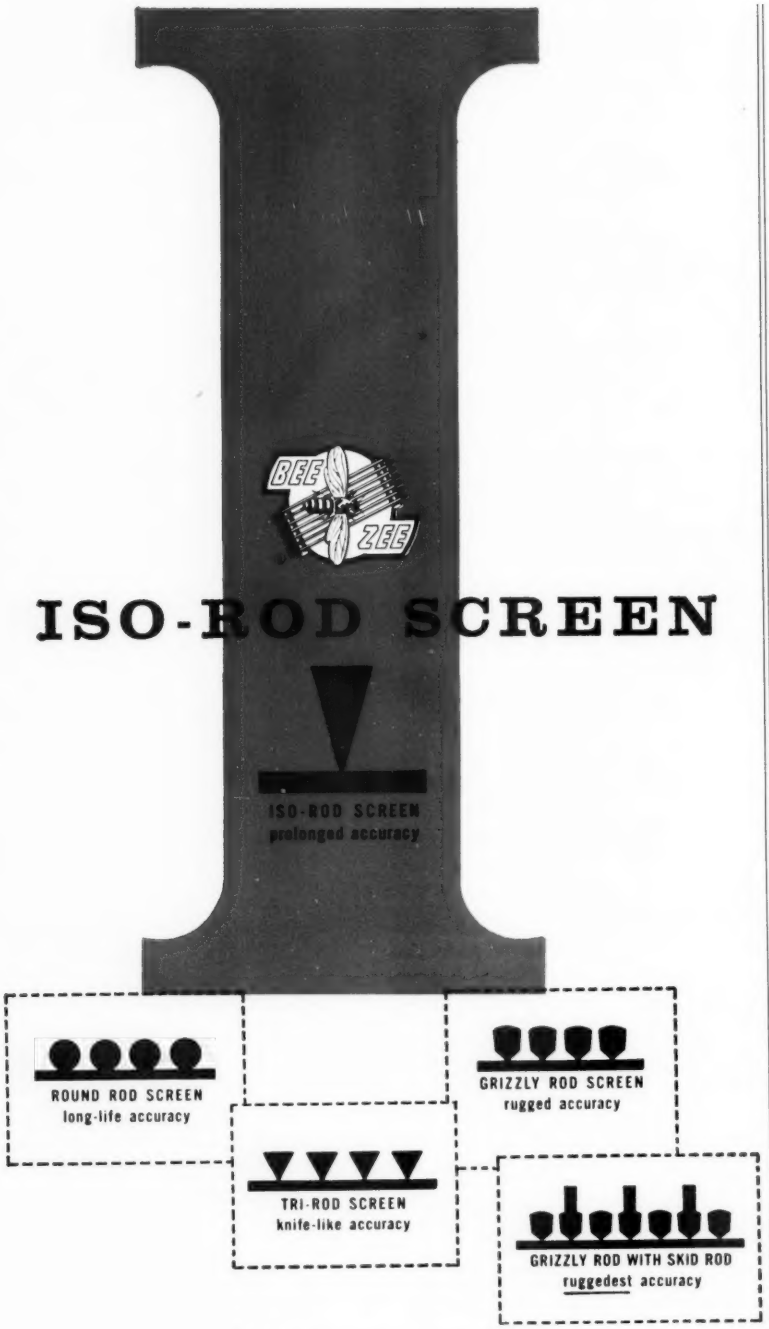

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Coal Mine Expansion

Construction of a giant tipple and processing plant at Clinchfield Coal Corporation's Moss No. 2 mine at Clinchfield, Va., is well under way.

Plans call for the coal to be brought from the mine to the top of the tipple by means of a conveyor belt. A large crushing room will be built inside the mine and a 31-ton crusher installed to crush the coal before it is conveyed up the slope to the cleaning plant.

This is only part of the company's $12,000,000 program for immediate expansion in the Wise and Russell County area. By 1959 the company expects to spend $18,000,000 annually on expansion in the two counties.

Big Bauxite Carrier

One of the world's newest self-unloading bauxite ore carriers is now under construction in Sweden.

The 17,300-ton vessel is being built by the Uddevalla Shipyard, Uddevalla, Sweden, for the Caribbean Steamship Co., S. A. Panama City, R. P., a Reynolds Metals Co. subsidiary. She will be 510 ft long, have a 70-ft beam and be 40 ft 9 in. from keel to main deck. A system of permanently installed conveyor belts will discharge the cargo.

The ship will operate between various Caribbean ports and the Reynolds plant at La Quinta, Tex.

Britain Looks at Our Coal Industry

British representatives of the Coal Mining industry team, visiting their counterpart industry in America recently, were inclined to credit American workers with better attendance records than British laborers. This information is reported by Mark J. Fitzgerald in his new book, *Britain Views Our Industrial Relations* published by the University of Notre Dame Press.

The British team gave several reasons for this record. The first factor cited is the great reduction in physical strain from working with mechanized equipment. Another influence mentioned is the small working crew and its sharp reaction to persistent absence by unit members. Another point is the uncertainty throughout a large area of the British coal mining industry in regard to the number of days in the year work is available. The British also learned from American management that installment purchasing plans act as a steady force to keep miners on the job.

British Trade Union officials reported that there is no more eloquent example to show the difference between rates of British and American industrial output than within the Coal Mining industry—the American output is four or five times greater per shift than the British.

Oswald Mine Closes

One of the oldest coal mines in Fayette County, W. Va.—the Oswald mine of the New River Co.—has ceased operation after 52 years during which several million tons of coal were produced. The worked-out mine, which employed 55 men in the production of about 300 tpd just prior to its closing, had produced as much as 1200 tpd with a payroll of as high as 200 men.

An outstanding fact in its operation noted in Federal inspection reports was that no fire, explosion or disasters had ever occurred at the mine.

Alcoa to Build Smelter and Aluminum Plant

The Aluminum Co. of America will construct a 150,000-ton smelter and a 375,000 kw coal-fired steam power plant near Evansville on the Indiana side of the Ohio River at a cost of approximately $80,000,000.

The new smelter will increase Alcoa's installed capacity—including that already existing and under construction—to 942,500 tons, boosting total United States primary aluminum production to about 2,400,000 tons.

John R. Ibach, a veteran of more than 31 years with Alcoa and recently electrical superintendent of the Company's operations at Massena, N. Y., will manage the smelter.

First production from the new plant is scheduled for late next year, using interim power from Southern Indiana Gas & Electric Co. Fully integrated operation of the smelter with its own power is expected by the middle of 1958.

Alcoa has entered into a long-term contractual arrangement with Peabody Coal Co. for the mining and supplying of coal to the electric power plant, which will be operated for Alcoa by Southern Indiana.

Employment at the smelter and power plant is expected eventually to reach 1200 with an annual payroll of $5,000,000. Facilities will include ingot-casting equipment, a carbon plant for manufacturing anodes used in the electrolytic smelting process, machine shops, electrical shops, a rectifier station, and offices and other service installations.

Docking facilities also will be constructed to handle river shipment of alumina from Mobile, Ala., and other raw materials.

Alcoa is also proceeding with plans to build an alumina plant costing more than $45,000,000 on a site adjacent to its primary aluminum smelter at Point Comfort, Tex. The new plant will produce more than 500,000 tons annually of alumina for the company's smelters at Point Comfort and at Rockdale, Tex.

Ben H. Sloane has been appointed manager of Point Comfort operations and J. Ranald Fox has been appointed works manager of the new plant at Point Comfort.

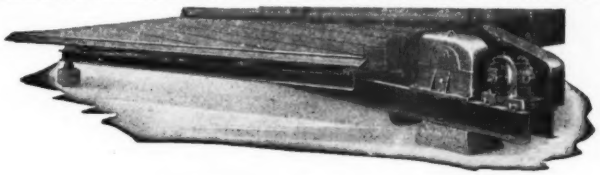
The plant will employ a minimum of 650 persons with a payroll exceeding $3,000,000 annually.

An ore-unloading dock will be built at a cost of about $3,000,000 as part of the project. The company will also provide rights-of-way for railroads and a public highway to the dock area.

Construction and maintenance of a proposed navigation channel from the plant site to the Gulf of Mexico will permit the company's ore carriers to bring bauxite directly to the plant site. More than 1,000,000 tons of bauxite will be imported each year. The proposed channel will accommodate 25,000-ton ships.

Timber Unit Formed

Clinchfield Coal Corp. has organized a lumber division to develop 100,000 acres of forest property in its southwestern Virginia holdings. The company announced that more than 72,000,000 board ft. of mature timber is ready for harvesting.



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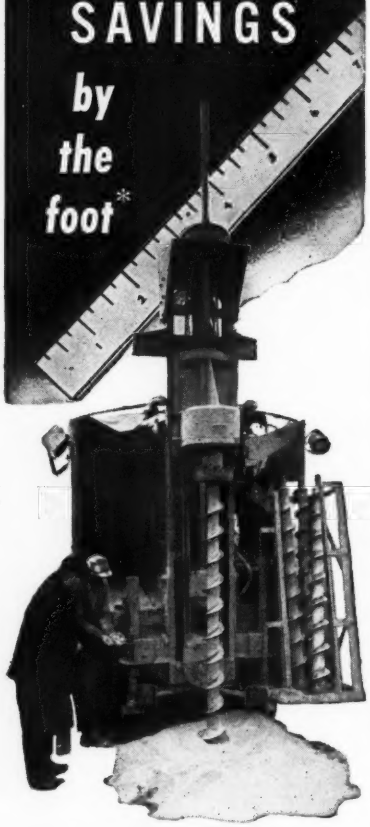

McCARTHY
NEW HEAVY-DUTY VERTICAL AUGER DRILL

**Strip Miner Drills 8-1/2" Blast Holes 60 Ft. Deep in 1 Hour, Including Moving Time.*

Savings, like costs, are measured by the foot, especially in tough earth and rock formations. Using the new McCarthy 106-24 Vertical Drill, this Pennsylvania strip miner cut drilling time to 1 hr. per hole (including moving time) on 60-ft. blast holes 8½" in diameter. Formation was 20 ft. of soft top strata, 35 ft. sandstone and 5 ft. of hard sandstone and bastard limestone.

A new speed reducer on Model 106-24 slows auger rotation for drilling harder rock formations. The result is more torque, or "biting power." You have fewer bit failures, cutting over-all drilling time. Driller above used tungsten carbide bits.

The McCarthy Model 106-24—"World's Fastest Heavy-Duty Vertical Auger Drill"—handles augers from 3" to 24" in diameter.

Write for Bulletin M-100

THE SALEM TOOL CO.
779 S. ELLSWORTH AVE.
SALEM, OHIO · U. S. A.

State Severance Tax Going Up

A bill proposing what appears to be the highest severance tax levied by any state on any mineral was introduced in the Louisiana Legislature on May 28. The bill, H. B. 671, would increase the rate on sulphur from $1.03 per ton to $3.00.

The proposed tax amounts to approximately 12 percent of the mine price of the great bulk of Louisiana sulphur. If the handling and storage costs are deducted, the tax represents close to 15 percent of the value of sulphur at the wellhead, the actual point of production.

The $3.00 tax has been advocated by the new Governor, Earl K. Long. The Legislature, which convened on May 14, thus far has approved by overwhelming majorities all the Long measures submitted to it.

New Mine Planned

Simpson Coal & Chemical Corp., of New York, owner of several coal mining facilities in Kanawha, Barbour, and Harrison Counties, W. Va., is planning to open a new mine for the extraction of coal from more than 10,000 acres in the Fairmont field.

"Our intention is to put up a mine with an output of 5000 tons per day which would involve the employment of from 250 to 400 men," a company vice-president has advised West Virginia state officials.

The company spokesman said his firm is negotiating for the acquisition of several other operating mining companies and for additional acreage of virgin coal.

Zinc Recovery Process

An electrolytic process which recovers more than 90 percent of the zinc contained in galvanizers' sal skimmings has been developed in a U. S. Bureau of Mines laboratory. The process recovers metallic zinc which is 99.99 percent pure.

Unlike the other zinc-bearing wastes of the galvanizing industry, sal skimmings do not respond to smelting and distillation. Heretofore the 25,000 tons or more of skimmings produced annually have been used as a source of such compounds as zinc chloride, and their price has remained low even during zinc shortages.

The new technique, described in detail in a Bureau technical report, written by P. M. Sullivan, chemical engineer, involves leaching the skimmings with spent electrolyte and hydrochloric acid. The resulting solution is then placed in an amalgam cell, where virtually all the contained zinc is recovered electrolytically.

A copy of R. I. 5205, "Electrolytic Recovery of Zinc from Galvanizers' Sal Skimmings," can be obtained from the Bureau of Mines, Publications Distribution Section, 4800 Forbes Street, Pittsburgh 13, Pa.

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SAND DRYING STOVES
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The standard for over 50 years
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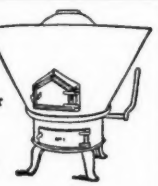

Buys Gauley Mine

Johnstown Coal & Coke Co. has purchased the Williams River No. 1 Mine and other assets of Gauley Mountain Coal Co. in the Gauley Field.

The mine, which has been renamed Crichton No. 5 by the new owners, operates in the Sewell seam and produces a high-grade metallurgical coal. It is located in the Williams River Valley 10 miles east of Cowen, W. Va.

Opened in 1944 by Gauley Mountain Coal Co., this mine has been operating in 5980 acres leased from the Gauley Co. and has almost 20,000,000 tons of Sewell coal in its reserves. Daily capacity, now approximately 1500 tons, will be more then doubled under an expansion program.

Operations will be conducted by a new subsidiary of Johnstown Coal & Coke known as Williams River Coal Co.

Fletcher
ROOF CONTROL DRILLS

Custom Built For *Your* Mine

A FLETCHER Drill can be custom-built to fit your every requirement from elements field-proven on more than 400 operating machines.

LOOK AT THE RANGE OF SPECIFICATIONS:

1. Heights from 28" to 14'.
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4. With dust collector, cable reel, floor-to-roof mast, timber saw, timber lift, Schroeder drill attachment, electric power take-off.

Write for further information on a FLETCHER Drill designed for your mine.

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Phone 44186

Forms Titanium Subsidiary

Kennecott Copper Corp. has formed a new subsidiary called the Kennecott Titanium Corp. The new organization is considering building a modern titanium sponge producing plant on a tract near Buffalo, N. Y.

Bubble Bath For Mine Fires

In the March 21 issue of *Life* magazine an experiment using soap suds to fight underground mine fires is described. Under development in England since 1950, the method calls for a solution of water and detergent to be sprayed on a fine mesh net stretched across the mine entry. Air blowing through the net creates billions of bubbles which form a foam plug that crawls down the length of the entry like a great lava flow of lather. In an actual flame test the foam plug worked so well, it was reported, that the air temperature near the fire dropped in two minutes from 1600° to 50°.

To Build Sintering Plant

United States Steel Corp. will build a large sintering plant for processing iron ores at its Youngstown, Ohio, works. The plant is slated to be ready for use by spring of 1957.

The project is part of a program of rehabilitating and expanding production of the Ohio Works which has been under way since 1946, and on which the company has spent more than $50,000,000.

The sintering plant will have a processing capacity of about 5000 tons of iron ore daily.

The new plant will consist of four parts—continuous traveling grate to carry the materials, special type furnace to fire fuel, series of wind boxes to accelerate fusing of the iron particles, and a fan of 400,000 cfm blowing capacity. Other equipment will include 4000 ft of conveyor belts and 100,000 cu ft of storage bins.

Acquires Aluminum Fabricator

Cerro de Pasco Corp., producer of non-ferrous metals, has arranged to acquire Fairmont Aluminum Co., of Fairmont, W. Va., an independent maker of aluminum sheet and coil.

Founded in 1926, Fairmont Aluminum has current annual capacity of 30,000,000 lb of sheet, strip, circles and specialties, and employs approximately 500 workers.

Cerro de Pasco is currently enlarging its electrolytic zinc plant in Peru to a daily capacity of 90 tons from the present 35 tons. The project will be completed by the end of this year. The plant attained full production early in 1954 and has actually produced at a rate in excess of the 35-ton capacity, with costs lower than originally anticipated.

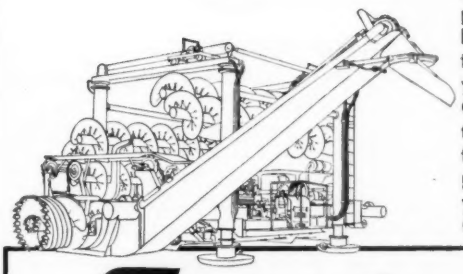
AND HERE'S *the* "BUSINESS END" *of the*

COMPTON COAL AUGER

● Just stop for a moment and study this photo of the Compton patented Lump Recovery Head . . . it certainly looks formidable even in print!

This non-clogging head was developed by Compton for exclusive use on the Compton Coal Auger. Driven by a power-packed diesel engine, the Compton Auger Head, with its top efficient core breaker, is a wonderful sight to behold as its 32 carbide tipped cutting bits cut and auger their way into the seam of coal in a jiffy.

A built-in spider bearing assembly provides "compass-straight" drilling with very little frictional drag. Engineered to cut coal at high speed, the Compton Lump Recovery Head will not clog and turns out a steady stream of coal from head to truck. Head diameters vary, depending on the size auger, from 44″ to 28″. The peripheral speeds maintained for all diameters makes it possible to get large tonnages even with the smaller diameter augers.



A Compton Coal Auger plus the Compton Lump Recovery Head will contribute to the efficiency of your operation. Call a Compton sales representative today . . . he is qualified to advise you on the possibilities which exist on your property for profitable Compton Auger Mining.

Compton, Inc.

ORIGINATORS OF COMPTON LUMP RECOVERY HEADS

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CLARKSBURG, WEST VIRGINIA

Penn-Dixie Promotions


F. L. Doolittle


L. L. Van Nest


H. R. Hamilton


M. L. Silcox


J. H. Jones


D. L. Hensley

Election of Fred L. Doolittle to the newly created post of executive vice-president of Penn-Dixie Cement Corp. was recently announced. Doolittle, who has served as vice-president and general sales manager since 1950, was also elected to Penn-Dixie's board of directors.

At the same time L. L. Van Nest was elected vice-president and general sales manager, Hugh R. Hamilton became vice-president and assistant to the president, and M. L. Silcox was made vice-president operations.

John H. Jones replaces Silcox as operations manager and Donald L. Hensley succeeds Mr. Van Nest as assistant general sales manager.

Strip Association Formed

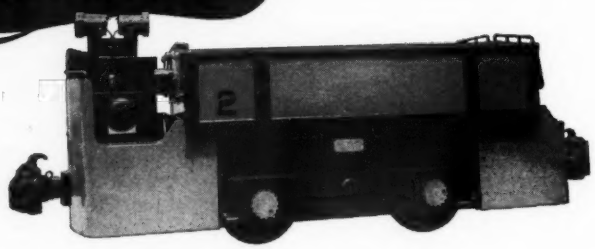
Nearly 300 strip, auger, and punch coal mine operators in West Virginia have formed the West Virginia Surface Coal Operators Assn., with Eugene M. Frederick of Clarksburg, as the association's first president.

Included in the organization's program will be efforts to establish more definite data and plans on rehabilitation of stripping areas with the cooperation of the State Mines Dept.

Other officers of the newly-chartered association are Columbus Wetzel of Clarksburg, first vice-president; Charles D. Bowling of Montgomery, second vice-president; Peter A. Denning of Dunbar, secretary, and Otha Compton, Jr. of Bridgeport, treasurer.

GREENSBURG EIGHT TON MONITOR
Storage Battery Locomotives

...for top performance "Double Equalizers" make the difference



The Greensburg 8 ton Monitor is equipped with two glass insulated motors, contactor type controller and double equalizers. These double equalizers make the difference in performance . . . more tractive effort, better brakes, better riding qualities and longer battery life than any other storage battery locomotive of equal weight and battery capacity!

All Greensburg locomotives are Custom-Built to meet your requirements in both single and double motor drive with drum, cam or contactor type controllers.

For more earning power per invested dollar specify Greensburg Storage Battery Locomotives.

GREENSBURG MACHINE CO.

112 Stanton St.
GREENSBURG, PA.

Fuller's Earth Plant Opened

Waverly Petroleum Products Co., Philadelphia, has opened a new plant to mine and process fuller's earth at a 3000-acre site near Meigs, in southwest Georgia.

An outstanding feature of the new plant is its materials handling system. All handling operations are mechanized or conveyorized, and at no time during processing of the raw material is it touched by a human hand except for inspection purposes.

William R. Harris, Jr., Thomasville, Ga., has been appointed plant manager. He was formerly associated with the Dawes Silica Mining Co. at Thomasville.

Sprague Acquires More Property

In its second large acquisition of Beckley area coal properties, C. H Sprague & Son Co., Boston, Mass.. has purchased the Gulf Mining Co., Mount Hope, W. Va. Gulf Mining Co. owned and operated the West Gulf mine, Maben, W. Va., and Crab Orchard mine, Crab Orchard, W. Va. The new properties are located in the Winding Gulf district.

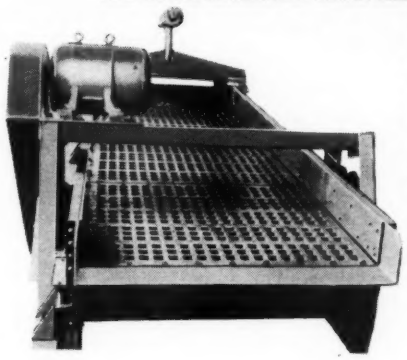
With Gulf Mining Co. currently producing at a rate over 1,000,000 tons annually, Sprague's total yearly output of prime low volatile metallurgical coking coal now approximates 7,000.-000 tons.

The Crab Orchard mine operates in the 48-in. Sewell seam, employing about 250 men who produce 1250 tons daily. Life expectancy of the mine is about 20 years. West Gulf mine is operating in the Beckley seam, averaging 38 in. thick on the property, and is estimated to have a life expectancy of 50 years. The mine employs about 350 men who produce 2500 tons daily.

Both mines are well equipped with modern preparation facilities.

Hendrick H Quality Steel . . . . . *Passes Every Test!*

The use of Hendrick *H* Quality Steel Perforated Plate on vibrating screens can often mean the difference between profit and loss. Hendrick Perforated Metal Plate really stands up under continuous heavy-duty usage . . . screens easier, faster and with less time out due to blinding.



Secret of Hendrick's success is our 80 years of experience in selecting and specifying the various analyses of steel best suited for the mining industry. Hendrick perforated *H* quality steel is supplied in flat, corrugated or stepped with any desired shape and size of perforation. For more information write Hendrick direct.

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EQUIPMENT FROM WORKED OUT MINE

EXCELLENT CONDITION

TLM 19 Exide 24-Cell Ironclad Battery in steel tray with covers and 3U-11020-X Permissible Fuse Box and Receptacle. (NEW)

Westinghouse MG Set 500 KW.

General Electric MG Set 200 KW.

Modern 5 track 400 ton per hr.—wet and dry wash coal preparation plant. Intact as a package deal.

W.S. Morgan Hoist — 250 H.P. for 460 ft. — 1¼" rope.

Clarkson Rubber-Tired Loading Machine—Type 28FA #1000, Red Bird Loader.

McKinlay Entry Driver—230 volts, D.C. 1 New GE—125 H.P. Motor.

Various other motors from 5 H.P. to 75 H.P.

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300 W. WASHINGTON ST. CHICAGO 6, ILL.

All Mining Men and Engineers are Invited To Attend . . .

The American Mining Congress . . . .

1956 ***Mining Show***

AMC

OCTOBER 1-4 • Shrine Exposition Hall *Los Angeles*

YOU'LL SEE the very latest in machines and equipment in the comprehensive displays of 150 of the nation's leading mining manufacturers and suppliers. Three complete floors of the exposition hall and a large outside area will be filled with their exhibits—everything from power shovels, huge trucks, tractors, mine locomotives, drilling equipment, engines and motors, conveyors, loaders, crushers, screens and other milling equipment—down to hand tools, instruments, roof bolts, belts, and a multitude of other items of equipment and operating supplies.

YOU'LL HEAR authoritative and timely discussions of today's mining problems. Industry leaders and top Government officials will cover national mining affairs—mineral policies, taxation, public lands, tariffs, stockpiling, labor relations, the future of the metals, problems of industrial minerals, uranium developments and other vital matters. Progress in exploration, underground and open-pit mining, and mineral treatment will be fully covered in special operating sessions.

YOU'LL ENJOY the opportunity to meet and exchange views with a fine crowd of mining men—not to mention the good fellowship of the Miners Jamboree and the Annual Banquet. Field trips on October 5.

No registration fee, except for representatives of manufacturers and suppliers who are not exhibiting or sponsoring the Show. If you are the authorized dealer or distributor for one or more exhibitors, you can arrange with them for your free registration. **Special Note to Oil Companies**—representatives of exploration and production departments are entitled to free registration. The usual non-exhibitor's registration fee applies only to sales and marketing personnel.

•

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American Mining Congress Housing Bureau, 1151 South Broadway, Los Angeles 15, Calif.

FOR FURTHER INFORMATION ▸ *Please Write*

American Mining Congress

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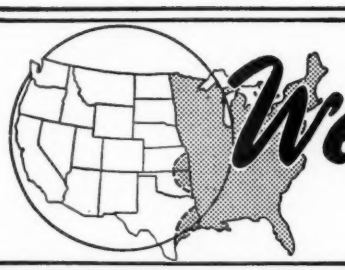


Western States

Add Alkaline Leach

Uranium Reduction Co. will add an alkaline leach system to its multi-million dollar uranium concentrator now under construction at Moab, Utah. This change will permit the company to treat ores of Big Indian District under the new "no lime" provisions of AEC purchase contract changes affecting Moab and Monticello purchasing stations.

Scholarships

U. S. Smelting Refining and Mining Co. has offered three scholarships for mining, geological and metallurgical engineering again this year, according to O. A. Glaeser, vice-president and manager of western operations.

Each scholarship, to begin with the 1956 term, is for a four-year course leading to an engineering degree with payments at the rate of $500 per year. One scholarship for study of metal mining or geological engineering and another for study in extractive metallurgical engineering are offered for study at the University of Utah. The third scholarship which offers a choice of metal mining, geological or extractive metallurgical engineering, will be awarded for study at Colorado School of Mines, Golden, Colo.

May Merge Borax and Potash Companies

Directors of Borax Consolidated Ltd., a British corporation, have announced in London that, following studies they have been making in cooperation with their financial advisers, they have decided to form a company in the United States to take over the greater part of the company's assets and operations in America. Consent of the United Kingdom Treasury to this transfer has been granted.

Completion of the transfer of these assets will bring to an American corporation the company's extensive boron deposits located at Boron, Calif., and factories for the increasingly important production of borax boric acid and numerous inorganic and organic boron compounds.

Announcements by both Borax Consolidated and the United States Potash Co. indicate that officers of U. S. Potash Co. and directors of Borax Consolidated and officers of its American division, Pacific Coast Borax Co., have held preliminary discussions with a view to a possible merger of the United States Potash Co. with the new company that will be formed. Borax Consolidated has for many years held a substantial stock interest in U. S. Potash Co. (at one time 50 percent of the company's common stock), and was largely responsible for financing the development of the potash company's mining and refining operations in the early 1930's.

An expansion and modernization program is now under way at Boron involving conversion from deep to open pit mining and a substantial increase in manufacturing capacity. This program is expected to be completed in the second half of 1957.

Ore Finds at New Park

New Park Mining Co. has encountered expected bedded lead-silver-zinc ores at the west end of the Park City mine on the 1755-ft level, W. H. H. Cranmer, president, has announced. The ore body is in step-faulted limestone and extends up to the 1630-ft level, where indications of bedding were encountered for the first time in the New Park mine, located near Keetley, Utah.

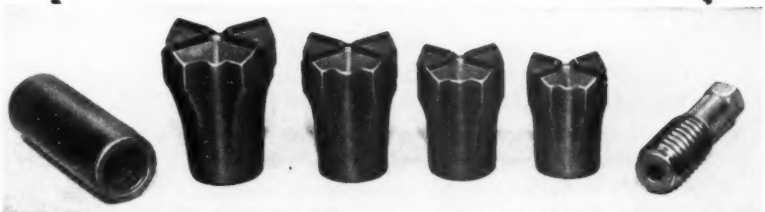
Recently chalcopyrite-bornite, enargite replacement ore of direct smelting grade has been found in the Deseret limestone on the Westward extension of the Mine on the 1630-ft level. This tends to confirm the ideas of management that New Park has possibilities of opening up bodies of copper-gold ore in the part of the Park City District principally known as a silver-lead District.

Morley Coal Mine Closes

The Colorado Fuel & Iron Corporation's Morley coal mine south of Trinidad, Colo., was closed May 4. All workable coal had been extracted from the mine during its 50 years of operation, according to the company. Officials reported that older miners among the 150 employes at the mine would be retired, while others will be absorbed at the CF&I Allen mine.

BRUNNER & LAY

"600" ROK-BITS



"600" Coupling 3½-in. Rok-Bit 3-in. Rok-Bit 2¾-in. Rok-Bit 2½-in. Rok-Bit 6-D "600" Thread

Brunner & Lay "600" carbide Rok-Bits® designed in conjunction with Gardner-Denver to fit directly on "600" series extension drill rods. No adapter needed! Rok-Bits' "X" design eliminates rifling, gives you a ROUND hole to load. Wider chip channels permit discharge of more and larger chips. Order from your distributor—if he cannot supply you, contact our nearest plant. Write for Bulletin!

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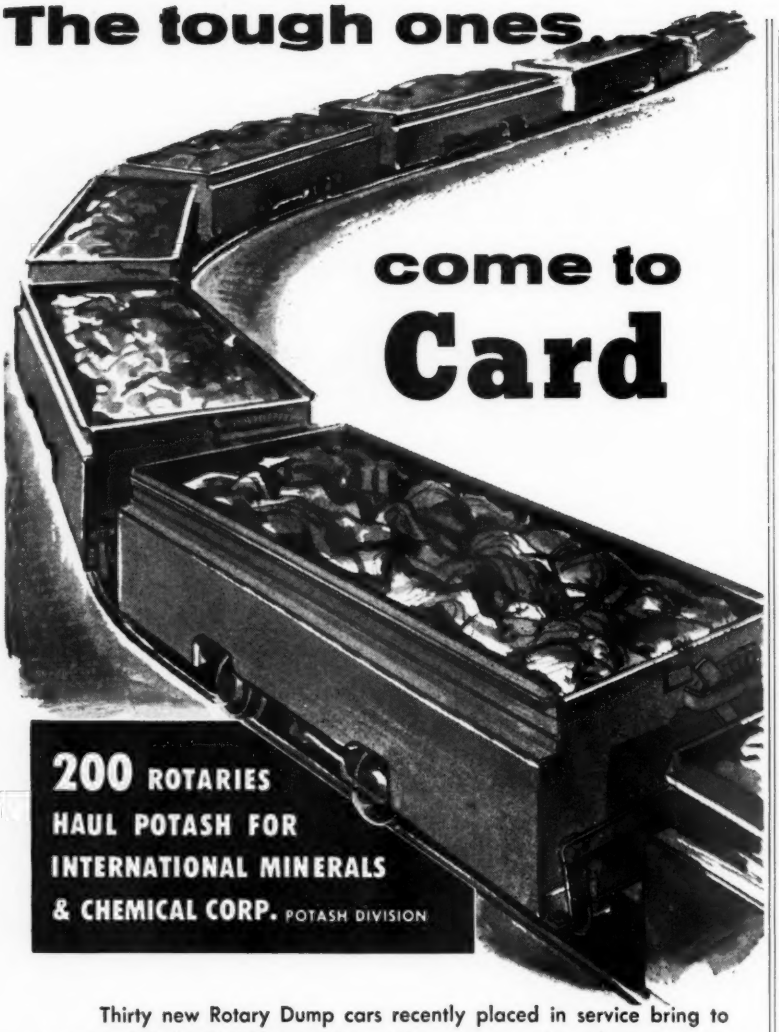
The tough ones...



come to Card

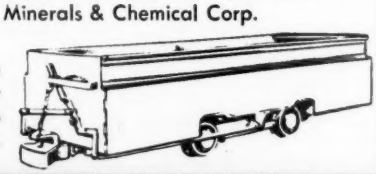
200 ROTARIES HAUL POTASH FOR INTERNATIONAL MINERALS & CHEMICAL CORP. POTASH DIVISION

Thirty new Rotary Dump cars recently placed in service bring to an even 200 the CARD Rotary Dump Mine Cars now in underground use at Carlsbad. Potash does not give the impact punishment CARD cars are taking in so many hard rock operations, but conditions are still tough.

Trains are long; haulage distances constantly increase; grades grow steeper. To keep in full operation economically, the cars have to be easy rolling, strong of frame, and solidly built against mild corrosion. All wheels are Timken bearing equipped and live rubber pads are used instead of conventional steel springs. They are 152 cu. ft. in capacity, struck measure, and track gauge is 42".

Aside from a heavier draft gear to meet the requirements of steeper grades and heavier trains, today's cars are little changed from those in the original order. Four re-orders over a period of years prove customer satisfaction at International Minerals & Chemical Corp.

You, too, can customize your haulage with an economical CARD design. Our engineers can furnish an efficient car to meet your most difficult specifications.



C.S. Card Iron Works Co.

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DENVER, COLORADO

AEC Seeks Men

U. S. Atomic Energy Commission desires graduate engineers with a minimum of five years' experience in the design, construction or operation of ore beneficiation plants. Salary will range from $6390 to $7570 per annum depending upon qualifications and experience. Submit resume of education, experience, and personal history to Personnel Office, U. S. Atomic Energy Commission, Grand Junction Operations Office, Grand Junction, Colo.

American Metal Uranium

American Metal Co., Ltd., is reported to have signed an agreement with Sabre Uranium Corp. and Pinon Uranium Co., Inc. which involves Sabre Uranium acquiring Pinon assets in exchange for Sabre common stock.

American Metal thereafter, subject to specified conditions, is to invest $4,500,000 in the resulting company—$2,000,000 for 25 percent of the common stock and $2,500,000 for preferred management of Sabre in the development of its stock. American Metal also is to act as manager of uranium properties in McKinley County, N. M., and the erection of milling facilities. The consummation of the agreement is subject to approval of stockholders and to the negotiation of satisfactory contracts with the Atomic Energy Commission.

Utah Potash

Delhi-Taylor Oil Corp. has developed a second and very considerable bed of potash ore northwest of Moab, Utah, according to Dr. Elton Soltes, Delhi potash project manager.

"We have demonstrated that a large blanket of sylvite (potassium chloride) covers substantially all of the area and we know that the total reserve is beyond any of our estimates," Soltes states. "But as we move west, the overburden increases due to the dip of the beds and the presence of an escarpment, and at this time we are not sure of how much deeper ore we can recover. We hope we can follow the ore body considerably deeper."

Soltes said a 23-mile railroad spur would be built from the main line of Denver & Rio Grande, and that water rights and a pumping site already had been obtained on the Colorado River.

The company has disclosed that it has obtained approximately 11 sections of additional acreage under prospecting permits, which brings present permit holdings to almost 30 square miles. Two of the original permits have been converted to leases and the remainder of the acreage will be converted when necessary, according to Soltes.

Safety Awards Presented

The Calera Mining Co. at Cobalt had the best Class A safety record and the Sidney Mining Co. at Kellogg had the best Class B safety record for the State of Idaho during 1955, while Class A and B improvements awards were made to the Star Mine at Burke and the Triumph Mining Co. at Hailey, respectively.

Awards were presented to the management and crews of the mines by State Mine Inspector George McDowell.

Acquire Sulphur Lands

Wyoming Gulf Sulphur Corp. has acquired 1200 acres of sulphur lands near Thermopolis, in Hot Springs County, Wyo. The company has announced that plans have been completed for a new mill which will produce a thousand tons per day. Construction of the mill is scheduled to start this summer with production to begin late this year.

— 6 —

Kennecott Arizona Expansion

Kennecott Copper Corp. plans a $40,000,000 project to extend the life and reduce production costs at its Ray Mines Division in Arizona, according to Charles R. Cox, president. Kennecott will build a smelter to handle the output of the Ray Division and plans to increase annual production from 50,000 to 70,000 tons by 1958. The present mining limits of the pit will be extended so that adjacent and deeper sections of the ore body can be mined.

Colorado Lead-Zinc Mill

Utaco Uranium, Inc. has announced plans to have a 250-ton lead-zinc mill in operation at Ouray, Colo., in the near future. D. E. Kivett, Utaco president, said the firm has acquired a lease option on the mill, known as the Silver Shield, and will use it to process ore from the Utaco's Bradley mine near Telluride, Colo., and from other properties in which the company is interested. The Bradley mine will reportedly produce at a rate of 100 tons a day by the time the mill is in operation.

Ready Gilsonite Facilities

American Gilsonite Co. has scheduled foundation laying for its new $15,000,000 coke refining unit at Fruita, Colo. The plant is expected to be in operation early in 1957, converting gilsonite, mined at Bonanza, Utah, to high-test gasoline and metallurgical grade coke for the aluminum industry of the Pacific Northwest.

Meanwhile the company has completed a four-compartment shaft to a depth of more than 800 ft at its Cowboy gilsonite vein near Bonanza. Drifting through use of combination mechanical and hydraulic jet piercing machines has been readied at Bonanza. The pipeline which will carry the gilsonite slurry in water from Bonanza to Fruita reportedly will be laid this summer.

It's a Date

See You in Los Angeles October 1-4

BEFORE you take off on that vacation you've been looking forward to for months, be sure to make your reservations for the year's biggest mining event—the Metal Mining and Industrial Minerals Convention and Exposition of the American Mining Congress in Los Angeles, October 1-4. Even better, plan your vacation to include this "must" meeting and bring your wife with you. Special events during the convention are planned exclusively for the ladies, and your wife will enjoy every minute of her stay in the metropolis of hospitable Southern California.

But whatever you do, don't delay sending your application for hotel reservations to the American Mining Congress Housing Bureau, Los Angeles Chamber of Commerce, 1151 South Broadway, Los Angeles 15, Calif.

The comprehensive "briefing on the previous 12 months' developments affecting every phase of metal mining and industrial mineral activities which will be crammed into the four days of Convention-Exposition doesn't just "grow like Topsy." Thousands of man-hours are expended to make certain that the program is well-rounded, to the point, and eminently worth-while to every convention-goer regardless of his specialty.

While much preliminary work has already been done, program preparation will receive impetus at a meeting in Los Angeles this month, when State and District Chairmen representing all of the Nation's great mining areas will formulate definite plans for the convention sessions. Scores of mining men, U. S. Senators and Representatives, and top Government officials will then be invited to participate in a broad program of both general and technical interest to the mining fraternity.

Of equal interest to mining people attending the convention will be the varied exhibits of more than 150 manufacturers of mining and processing machinery, equipment, and supplies in and adjacent to the Shrine Exposition Hall. These displays, ranging from mammoth earth-moving equipment of latest design to minute bearings, will occupy more than 88,000 square feet of floor space.

Entertainment features will include the Miners Jamboree and the annual Speechless Banquet, as well as two special luncheons for the ladies. If these aren't enough in the way of top-flight entertainment, the Los Angeles area teems with all types of attractions for visitors.

Several trips to nearby mining and industrial operations and to Walt Disney's Disneyland have been scheduled for Friday, October 5.

Happy Jack Option

The Texas Co. has obtained option to purchase the Happy Jack Uranium mine in White Canyon, San Juan County, Utah from Bronson & Cooper Mining Co., Monticello, according to Joe Cooper, partner in the firm.

The Texas Co. has a joint interest in the new New-Shat-Tex Corp., along with New Jersey Zinc Co. The Shattuck-Denn Mining Co., originally a member, sold their interest and stock in the joint venture. New-Shat-Tex has submitted a proposal to AEC for establishment of a uranium mill and uranium oxide treatment plant to be built on Navajo Indian lands near Mexican Hat, Utah.

The purchase price contained in the Texas Co. option was not revealed.

Anaconda Butte Expansion

Anaconda Co. has announced a $36,000,000 mining and development program for its Montana copper and zinc operations.

Chester H. Steele, vice-president in charge of western operations, said the company plans to spend about $20,000,000 on the Ryan shaft at Butte, which will provide for development and mining of vein-type copper and zinc ores in an undeveloped section. Another $7,000,000 is earmarked for equipment at the Berkeley pit, Steele said, which was recently brought into production as an open-pit operation at Butte. In addition, Anaconda plans to spend approximately $9,000,000 for mill and smelter changes at Anaconda, and for railroad rolling stock for the Butte, Anaconda & Pacific railway. The railway is used to carry ore from the mines at Butte to the Anaconda smelter 22 miles away. Steele said the company plans to add about 2500 men to its Butte payrolls by the end of 1960.

WANTED

Rare Earth Ores

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MONAZITE • SAMARSKITE • THORITE

THORTVEITITE • XENOTIME.

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MICHIGAN CHEMICAL CORPORATION
Rare Earths Division. Saint Louis, Michigan

Oil Shale Mine to Open

Union Oil Co. of California has announced that its pilot plant program for recovery of oil from shale near Rifle, Colo., will be in operation by the end of next summer.

Kennecott Scholarships Continue

Kennecott Copper Corp. has announced that the Chino Mines Division, Santa Rita and Hurley, N. M., are again offering 11 scholarships to students enrolled in southwestern colleges. W. H. Goodrich, general manager of Chino, said that winners of awards will be named this spring, and that scholarships will be effective during the 1956-57 school year. There will be no change in distribution of the scholarships—four will go to the New Mexico College, Silver City; two each to the University of New Mexico and New Mexico A & M; and one each to Highlands University, Eastern New Mexico University and Texas Western College, El Paso.

New Mexico Uranium Mill

Foley Metals Corp. has announced it is negotiating with the Atomic Energy Commission for permission to construct a uranium mill in the Ambrosia Lake uranium district near Grants, N. M. The new corporation is owned by Rio de Oro Uranium Mines, Inc., United Western Minerals, and the Foley interests.

Clyde E. Osborn, former manager at the Shiprock, Ariz., mill of Kerr-McGee Oil Industries, Inc., will manage the Foley Metals project.

Uranium Compounds

Climax Molybdenum Co. and Mallinckrodt Chemical Works have agreed to submit a joint proposal to the Atomic Energy Commission for the construction and operation of a privately owned plant for the refinement of uranium compounds, according to Arthur H. Bunker, Climax president and Charlton MacVeagh, Mallinckrodt vice chairman. In the event the proposal is approved by AEC, a jointly owned company would be formed to construct and operate such facilities. Under terms of the agreement, Climax

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HERE ARE JUST A FEW OF THE ITEMS OFFERED

5 BU Joy Loading Machines 250 V. DC. 42" Track Gauge.

Dooley Bros. Track Mounted drills, two drill arms mounted, on 42" Track Gauge self-propelled truck, 260 V. DC.

600 ALL STEEL PIT CARS

Capacity 4.4 tons, 42" track gauge end dump.

15-Ton G.E. Trolley Type HM820, 250 V. DC. 42" Track Locomotives.

Assortment of Mine Pumps.

7 B-1 Sullivan equipped with Joy bug dusters on Caterpillar trucks.

UNITED CONVEYOR ASH REMOVAL SYSTEM.

VIBRATING SCREENS.

300 K.W. WESTINGHOUSE MG SETS consisting of Motor, 432 H.P. Synchronous, 2200 volts, Generator, 275 volts, D.C. 1090 Amps. Complete with starting equipment.

ELECTRIC MOTORS—1/4 H.P. to 25 H.P.

Mine hoisting equipment and service parts for Mining Equipment.

HUNDREDS OF ITEMS IN EXCELLENT CONDITION

CHICAGO WILMINGTON & FRANKLIN COAL COMPANY
300 WEST WASHINGTON STREET • CHICAGO 6, ILLINOIS

Oregon Cement Expands

Following their first major expansion of 900,000 bbl per year at Oswego, Ore., Oregon Portland Cement Co. has announced that a new kiln and related equipment has been ordered for their plant at Lime, Ore. The Lime expansion will increase the present capacity of 500,000 bbl per year to 1,500,000 bbl per year at an estimated cost of $3,000,000.

Wheels of Government

(*Continued from page* 88)

remains to be seen. Chances of passage of some measure are viewed as favorable.

Minerals Purchase Programs

At this writing, officials of the Office of Defense Mobilization and the Interior Department are still scheduled to testify before a Senate Interior subcommittee on numerous bills designed to initiate or extend Government mineral purchase programs for tungsten, manganese, chromite, mica, asbestos, beryl, columbium-tantalum, mercury and antimony. Industry representatives have completed their testimony and were unanimous in urging continuation of the present programs and the establishment of one for antimony.

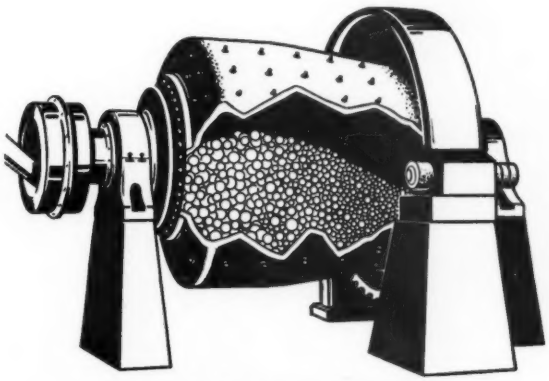
The Capitol is alive with rumors as to what course the Administration will take over the question of extending the buying programs. There are those who predict that the Government agencies will come out flatly against any extension measures. They base this on the fact that the Office of Defense Mobilization has already advised that from a defense standpoint there is no need of legislation to continue the programs.

On the other hand, there are those who predict that ODM will issue directives to the General Services Administration telling it to continue to buy the minerals now under purchase programs until such time as the goal for each material is met or funds earmarked for it are depleted. This latter course would have the effect of extending the termination dates for some minerals and metals which have not reached their goals. It would mean the end of purchase programs for asbestos, tungsten and low grade manganese. These same observers predict that the Administration will seek a one or two year's continuation for purchase programs for tungsten (at a reduced price) and asbestos.

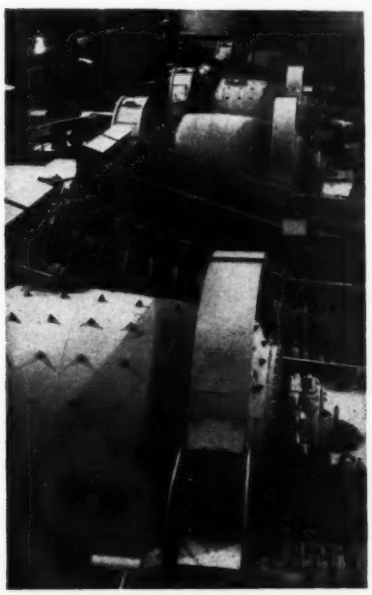
Of the two courses outlined the latter is believed to be the most logical one to be followed by the Administration. It is predicted, however, that the Administration will not support any proposal for an antimony buying program nor for a low grade manganese purchase plan.

Senate Committee aides indicate that should the Administration extend most of the buying programs by directive, the Committee will report out purchase plans for those minerals not covered by such action. Of course, any legislation approved by the Congress in the face of opposition by the Government agencies is likely to be headed for a veto.

Meanwhile, GSA has announced the status through March 31, 1956, of the purchase programs, as follows: *Tungsten*—2,652,328 short ton units delivered against a goal of 3 million short ton units; *manganese*—2,184,950 units delivered to Butte and Philipsburg out of a goal of 6 million long ton units each (the Wenden and Deming goals are closed), and 6,174,790 units delivered out of a goal of 19 million long ton units in the carload program; *chrome*—105,652 long tons delivered against a goal of 200,000 long tons; *mica*—7,965 tons delivered against a goal of 25,000 tons; *beryl*—914 short tons delivered against a goal of 1500 short tons; *asbestos*—1425 tons delivered against a goal of 1500 short tons; and *mercury*— 5 flasks delivered against a domestic purchase goal of 125,000 flasks.



TRICONE MILLS



Highest grinding efficiency and *lowest* ball and lining wear are common to mills with a correctly segregated ball charge.

The *Hardinge Tricone Mill* is the only mill providing these essentials to low cost operation *without* the use of special linings or internal devices, which are subject to wear and are effective through only a part of their wearing life.

Complete specifications upon request. Bulletin AH-414-52.

Four 11′ diameter Hardinge Tricone Mills at a Canadian Concentrating Plant.

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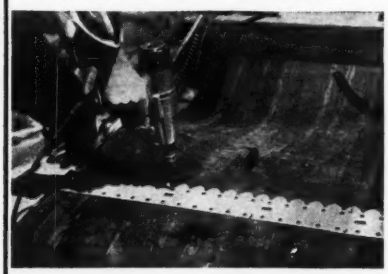
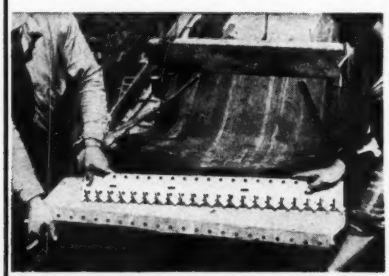
NEW FLEXCO SPEED TOOLS

CUT APPLICATION TIME IN HALF

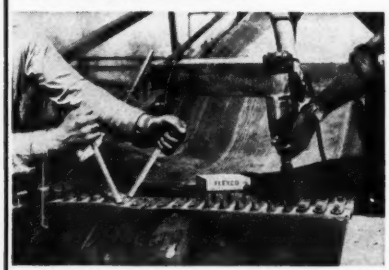
Your two man belt team can now join a belt 30" wide in 15 to 20 minutes . . . using the new FLEXCO Power Tools.



The FLEXCO Power Tool Boring Bit used with electric or air impact tool speeds boring of holes.



New FLEXCO Templet positions bolts for quick joining of belts. Reaching under belt has been eliminated.



Running down nuts is fast with the new FLEXCO Speed Wrench used with electric or air impact tool. Two Bolt Breakers are used together to complete the joint.

If you are interested in speeding up fastener application, order the new Speed Tools from your local FLEXCO Distributor. Write for Bulletin F-112-A.

FLEXIBLE STEEL LACING CO.

4675 Lexington Street • Chicago 44, Illinois

Close Black Powder Plant

Hercules Powder Co. has closed its last black powder plant at Hercules, Calif. The California Powder Works was acquired by Hercules in 1913 and had continuously produced black powder since that time.

Meanwhile, Hercules anticipates completion of the $2,000,000 expansion of its Bacchus, Utah, plant by the end of this year. Hercules will supply explosives from the Utah plant to all areas of the Western United States.

Research Firm Formed

Geomar Mineral Research Laboratories, consisting of five integrated laboratories for petrographic and mineral analysis, X-Ray, spectrographic, chemical and radiometric analysis has been organized at Rolla, Mo., with George Sonewald, Jr., as general manager.

Sonewald, formerly associated with the U. S. Bureau of Mines, will be assisted by Gordon B. French, petrographer and geologist, until recently assistant research geologist with the St. Joseph Lead Co. and instructor in mineralogy at the Missouri School of Mines.

The new laboratories will provide not only mineral identification and routine analysis, but also coverage in petrographic evaluation of rocks and clays, grain size determinations core analysis, sections, photomicrographs, trace element determinations, and physical properties.

Set Accident Record

A minor accident on April 18, interrupted 126 consecutive working days without a lost-time accident and marked the first lost-time accident during 1956, at the Hurley N. M., plant of Kennecott Copper Corporation's Chino Mines Division. The plant includes the division's mill, smelter, refinery and power plant.

On March 9, the plant's 1200 employes equalled the best previous plant record of 86 working days without a lost-time accident which was established in 1945, and extended the old record by 40 days in setting the 126 working days accident-free record.

W. H. Goodrich, Chino general manager, credited employe cooperation with the company's safety program for setting a new record.

Paul Hunter, Hurley safety engineer, pointed out that in the 126 days the 1200 employes at Hurley had accumulated over 938,000 man hours of exposure without a lost time accident. Kennecott's Hurley plants accident frequency rate is now 1.06. This compares with the national industrial average of 7.22 based on 1954 figures for each million man hours of exposure.

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GEOPHYSICAL EQUIPMENT FOR LOCATING BASE METAL, SULFIDE OR MAGNETIC ORE BODIES

For more accurate delineation of ore bodies . . . more precise selection of drilling sites . . . depend on SHARPE! These famous instruments have accounted for many of the major mineral discoveries in Canada, South America and the U. S. Why not equip your field parties with SHARPE Instruments now?

Electromagnetic Survey Unit (SE-100)

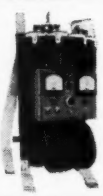
For locating base metal deposits which may not produce marked magnetic anomalies. Compact. Portable. $2995.

Vertical Force Survey Magnetometer (A-2)

Designed for one-man operation. Faster coverage, lower labor cost. Sensitivity: 10 gammas or more per scale division. $1995.

Vertical Force Recon Magnetometer (D1-M)

For delineating structures with abnormally high magnetic characteristics and ground checking magnetic maps. $610.



Self-Potential (SP-5) & Resistivity Unit (SP-5R)

For primary gold and base metal exploration to reveal location of disseminated sulphides. Four electrodes. Self-potential only, $715. With Resistivity attachments. $1210.

Dip Needle (Lake Superior Type)

The simple, economical instrument for locating drift-covered magnetite and pyrrhotite, or ultra basic rock intrusives. $185.

Also money-saving prices on Geiger Counters—Scintillometers—Drill Hole Probes and Reels—Ultra-Violet Lamps.
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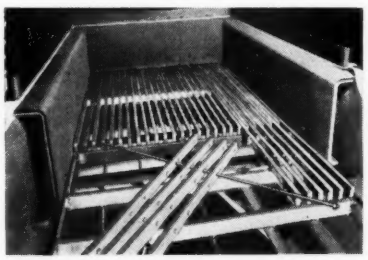
Manufacturers Forum

Grates

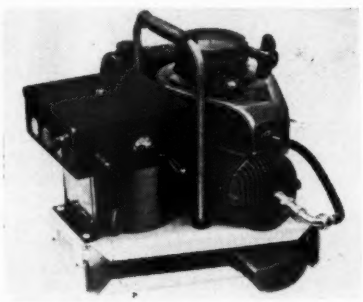
A NEW GRATE DESIGN has been introduced by Allis-Chalmers Mfg. Co. for the feed end of its Air Quenching clinker cooler. All feed end grates are "L" shaped, 2½ by 1 in. in size. They are staggered longitudinally to form a rigid heat resistance surface. The grates are held



tight by long through-bolts which expand and contract with the grates. The bolts are accessible from outside the cooler to permit cinching up when required. Existing Air Quenching coolers may be converted to accommodate the new style grates.

Bantam Weight Generator

A COMPLETELY SELF-CONTAINED gasoline engine-driven generator package, the Model 5903 Series supplies either 1350 watts of d-c power or 1500 watts of 400 cycle a-c



power. It weighs less than 35 lb and is contained in a 1.5-cu ft package. Fuel consumption is said to be about one quart per kw hr. The engine, which is air-cooled, has an automatic rewind starter, and is equipped with a muffler.

Specifications and availability for this and other models, may be had by contacting Lear, Inc., LearCal Division, 3171 S. Brundy Dr., Santa Monica, Calif.

Dust-Fume Collectors

THE Zack Co., 4600 West 12th Pl., Chicago 50, Ill., has announced initial production of floor type and cone type dust-fume collectors. Essentially, these units consist of a cylindrical drum and internal wash-producing structures. In action, the dust collectors present a series of closely related water curtains through which dust and fume laden air is filtered in its upward travel. The collectors incorporate flat bottoms to serve as settling tanks from which the water is recirculated. A chute type of cleanout is provided for simple hand cleaning of settling tank. The collectors are also produced with flight conveyors for automatic ejection of sludge from tanks to containers.

Inquiries about new equipment appearing in Manufacturers Forum are welcomed. For additional information on any piece of equipment in this section write directly to the manufacturer, or to Mining Congress Journal with name of item and date of issue in which it appeared.

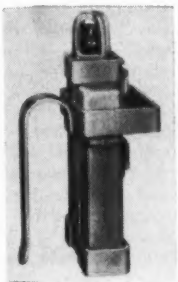
Automatic Sampler

AN AUTOMATIC SAMPLER with end carriage has been introduced by Denver Equipment Co. engineers to provide accurate sampling results in normally inaccessible places. By taking the whole of the stream part of the stream. Constant intervals berors resulting from variations across the time, this sampler eliminates ertween cuts are maintained to obtain equal representation of the entire length of the stream.

For information about this unit, write Denver Equipment Co., P. O. Box 5268, Denver 17, Colo.

Trip Lamp

APPROVED by the U. S. Bureau of Mines, the Edison Four-Cell Trip Lamp is rectangular in shape and designed to be hung quickly by its forged steel hook on the side or back of any mine car. The battery may be recharged on any Edison R-4 lamp charging rack without additional equipment. Request Bulletin No. 0201-2 from Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh 8, Pa.



Portable Compressor

A ROTARY COMPRESSOR with 600-cfm capacity has been announced by the Joy Manufacturing Co., Oliver Building, Pittsburgh 22, Pa. The portable Joy Airvane is reported to have a weather-proof exterior housing of high-strength steel, a low-center of gravity, and a short turning radius of 13 ft. The compressor incorporates the Thermal By-Pass feature, heart of the Airvane temperature control system, and a controlled-velocity filter-separator unit for removing oil from the compressed air.

Drill Bits

TWO SERIES of coal roof drill bits and auger bits have been announced by Carmet, the cemented carbide producing facilities of Allegheny Ludlum Steel Corp., Room 2036, Henry W. Oliver Bldg., Pittsburgh 22, Pa. The new designs are the TT style roof bits, offered in 1-⅜, 1-7/16, and 1-½ in. sizes, and the WW style coal drill bits in 1-⅞ and 2-in. sizes.

It is claimed the new designs have incorporated features which aid in giving faster penetration and greatly increased tool bit life. One of the features is the increased steel support for the carbide tip, the added support allowing a harder, more wear resistant carbide grade to be used in the bits.

Truck Tire

VIRTUAL ELIMINATION of groove cracking and greatly increased resistance to side slippage are reported features of a new off-the-road tire just announced by United States Rubber Co. The tire, called the Super Fleetmaster, is designed particularly for use on dump trucks and other heavy service equipment used in logging, mining, quarrying and road construction work.

The Super Fleetmaster with a nylon cord body is being made in sizes from 12.00-24 with a 16-ply rating through 16.00-25 with a 24-ply rating.

Control Panel

AN ELECTRICAL CONTROL engineered by the Industry Control Department of The General Electric Co. has been installed in the coal crusher house at the Chillicothe, Ohio, plant of The Mead Corp. The control features a built-in illuminated diagram by which the operator maintains a remote check on all coal processing. This enables the operator to select the correct movement for the coal and to direct its flow to the storage yard or power house via the conveyor.

Portable Compressor

WEIGHING 14,340 lbs ready-to-go, the Gyro-Flo 900, a rotary compressor, can deliver 900 cfm at 100 psi. The design of its General Motors series 110 diesel engine enables it to maintain rated brake horsepower at high altitude, and its 24-v battery and ether-capsule system permits sure-fire starting at low temperatures, according to manufacturer.

For additional information write to Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y., and request Form 2313.

Tree Planter

TWIN SEAT DESIGN and extra large holding tray are featured in the Forestview Tree Planter which may be used for handling lining-out stock and other small plants, subsoiling, and scarifing. For reforestation, con-

servation and water shed planting, this "Tandem" planter has a wheel control for following uneven contours. Other advantages attributed to the planter are replaceable steel trench spreader, manganese steel point, and heavy carbon steel beam and ball-bearing mounted heeling wheels.

Complete information and prices are available from the manufacturer, Forestview Evergreen Nurseries, Germania, Pa.

Vibrator

BANTAM-SIZE VIBRATOR for operation on steam or air, the Vibrolator SAH-10 was recently developed by the Martin Engineering Co., Neponset, Ill. Weighing only 4 oz, it is designed for use on hoppers, feeders, molds, gauge panels and packaging machines. Frequency of vibration is

infinitely variable from 0 to 50,000 cpm. Operating pressure may vary from 5 to 150 psi.

A catalog describing this self-starting, self-cleaning, and sparkproof mechanical vibrator will be sent on request to the company.

Perforated Plates

NEW SPECIFICATIONS on perforated plates have been released by the Pyramid Screen Co. They include: smaller holes down to 0.01 in. in mechanical perforation and down to 0.001 in. in electrolytical perforation; thicker plates; non-blinding conical shaped holes; new Venturi, or hour-glass perforations, for back wash; and round, square and slotted perforations.

Samples and full descriptive matter may be obtained from Pyramid Screen Co., 30 Church St., New York, N. Y.

Big Ball Mill

AN OVERFLOW BALL MILL, the largest such mill ever to be built by Allis-Chalmers Mfg. Co. for the mining industry, will be shipped in mid-1956 to the Climax Molybdenum Co., Climax, Colo., for use in its concentrating process.

When completed, it is believed by the manufacturer that the 13 by 12-ft mill will be the largest diameter mill of its type in the world.

Slip-Proofing

HEAVY-DUTY GRIP, a slip-proofing finish, sticks to metal, wood, concrete, and glass, and can be used indoors or out. Claimed to be immune to water, gasoline, oil, grease, solvents or fats, it is sandpaper-like in texture and self-bonding. Grip comes ready-mixed for application with trowel and is available in brilliant aluminum finish and also in neutral brown color for application where higher visibility is not essential.

Heavy-Duty Grip is manufactured by the Hallemite Mfg. Co., 2446 West 25th St., Cleveland 13, Ohio.

Take Up Belt Stretch

A MOTOR BASE, which it is reported requires no regular maintenance for proper drive belt tension, is called the No. 500 "Tens-A-Matic." It is said the base automatically takes up belt stretch and absorbs starting loads.

The "Tens-A-Matic" is available for motors of all sizes, from fractional hp to 200 hp. Manufacturer and distributor is Murray Equipment Co., Inc., 11350 Schaefer Hwy., Detroit 27, Mich.

Air Compressors

A NEW LINE of heavy duty, two-stage air compressors has been announced by Emglo Products, 80 Messenger St., Johnstown, Pa. All ratings through five hp in horizontal and vertical tank mountings, base mounting and bare compressors are available. Larger sizes will be ready in the near future.

The air-cooled compressors feature large bore and stroke, slow speed, Timken main bearings, intercooler and aftercooler, large fan and grooved flywheel, and loadless start by means of a centrifugal unloader.

Changeable Typewriter Type

REMOVABLE AND INTERCHANGEABLE typewriter type is featured on the 1956 Remington Standard Typewriter.

The interchangeable type will allow one machine to do the work of

several. The switch from straight correspondence to technical reports using special type symbols, or from any one of the 116 Remington Rand Executive Type Styles to any other, can be accomplished on the spot.

All current and old model Remington Standards and Electrics can be re-equipped with special type-bars to receive the new interchangeable type faces.

Copies of booklet R-8794 are available at Remington Rand sales offices or by writing Remington Rand, a Division of Sperry Rand Corp., 315 Fourth Ave., New York 10, N. Y.

Polyester Insulator

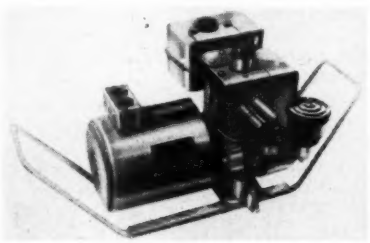
AN INSULATOR, with high mechanical and electrical strength, for traveling crane trolley feed conductors, has been announced by Red Seal Electric Co., 6321 Detroit Ave., Cleveland 2, Ohio.

The "504 insulator" is used to replace hardwood conductor posts on trolley feed runways. Designed for service up to 1000 v, it is 1-⅞ in. diam by 2¼ in. long and according to the manufacturer, rugged enough for heavy duty installations.

The "504 insulator" is made of polyester, reinforced with fiberglass, and has two tapped inserts for installation. All insulators are tested at 10,000 v before shipment.

Portable Power Plant

AN ELECTRIC PLANT weighing 88 lb and rated at 1000-watts continuous duty has been announced by International Fermont Machinery Co., Inc. It comes as a completely operable basic unit with separately available special accessories. The basic unit is a manual-starting, 2-wire, 60-



cycle, a-c, single-phase set. The entire unit is permanently aligned and mounted on a steel-base-and-carrying-handle combination. Two receptacles are incorporated for electrical load connections. The plant with air-cooled gasoline engine is available from the company in Ramapo, N. Y.

Power Scraper

"COBRETTE," a 10-yd self-propelled scraper, features fluid coupling drive, a positive power "Gear Steer" actuated by hydraulic rotary cylinders, and a frame and power train that permits one unit to aid in push loading another. Rated at 7.5 cu yd struck and 10 cu yd heaped, the 143-hp diesel powered unit has speeds up to 30 mph.

Additional information is available from CCS Wooldridge distributors, or Wooldridge Mfg. Division, Continental Copper & Steel Industries, Inc., Sunnyvale, Calif.

Scintillation Counter

A SCINTILLATION COUNTER, Gardiner Electronics Model 143, has been placed on the market with a built-in loud-speaker alarm. The loud-speaker starts giving out a tone when a preset gamma radiation level is reached and increases in pitch proportionally when this level is exceeded. The counter also has provisions for headphones and features a built-in battery tester.

Additional data can be obtained from Gardiner Electronics Co., 2545 E. Indian School Rd., Phoenix, Ariz.

Safety Spectacle

MODERN, clean-flowing lines and attractive design are claimed for this new Metal Styl-Ize Safety Spectacle. With USSS Co.'s Optilite or hardened glass lens mounted in this metal frame, the entire unit, according to

the firm, meets all Federal specifications for strength, optical qualities, impact and piercing tests, and resistance to corrosion.

This product was developed and is offered by United States Safety Service Co., 1215 McGee St., Kansas City 6, Mo.

Magnetic Vibrator

CALLED the Eriez HI-VI Unit Vibrator, this unit needs no rectifier as it operates at 3600 vpm directly off an ac line.

Two models are now available for handling bulk materials in lump or powdered form. EU-20 is designed for bins of seven-cu ft capacity and up to 1/16 in. thickness of bin wall. Model EU-30 is designed for bins of 20-cu ft capacity and up to 3/16 in. thickness of bin wall.

Complete detailed specifications may be obtained by addressing the Eriez Mfg. Co., Erie 6, Pa.

Radiotelephone

SPECIFICALLY DESIGNED for installation on materials handling trucks, messenger vehicles and transportation units, the small low-power industrial radiotelephone weighs 21 lb and measures approximately 12 by 8 by 5 in.

Designated IMP, Industrial Mobile Phone, it is capable of performing the triple duties of base station, mobile unit and mobile public address system. It has a range from one to five miles and can operate on 6 v dc, 12 v dc, or 117 v ac.

The IMP is shock mounted and all controls have been recessed for protection.

For specific or dealership information write Kaar Engineering Corp., 2900 Middlefield Rd., Palo Alto, Calif.

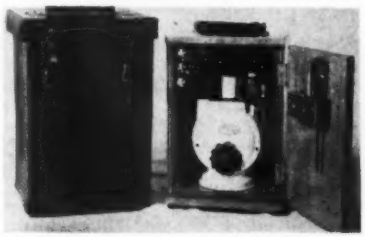
Change in Compressor Oil Pans

ALL LE ROI two-stage portable compressors and Tractairs are now manufactured with new, deeper oil pans, according to word from the manufacturer, the Le Roi Division of Westinghouse Air Brake Co., Milwaukee, Wis. The deeper oil pans allow the compressors and Tractairs to operate in more rugged terrain than the previously manufactured units.

The new oil pans allow portable operations at angles up to 20° and Tractair operations at angles up to 25°, both more than double the previous operation angles and an advantage when working in rugged terrain. The 365 cfm and 600 cfm Le Roi compressors have been equipped with the deeper oil pans for several years.

Magnetometer

THE SHARPE MODEL A-2 Vertical Force Magnetometer, a Schmidt-type magnetic balance for measurement of the vertical magnetic field intensity of the earth, can, according to the company, be used to trace favorable ore formations in drift-



covered areas, and can serve as a direct guide to favorable ore locations in the absence of rock outcroppings. The A-2 magnetometer has a permanently attached compass for orientation to permit complete one-man operation and has a sensitivity of 15 gammas per scale division and an intensity range of 0 to 15,000 gammas.

For more information write The Radiac Co., Inc., 489 Fifth Ave., New York 17, N. Y.

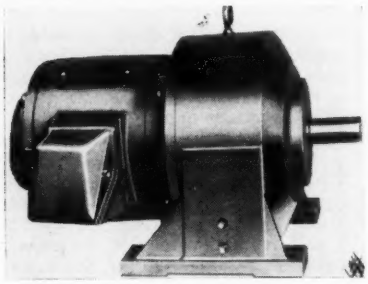
Portable Seismograph

SEISMOLOG, a portable lightweight seismograph, is a recent development by Vibration Measurement Engineers, Chicago. Operated on a two-section low-voltage battery pack designed for the instrument by General Dry Batteries, Inc., Cleveland, the Seismolog records impact vibrations in industry and construction by photographing them automatically The records are particularly useful in industrial operations involving the use of commercial explosives in the event of lawsuits.

The Seismolog weighs 40 lb in its case, and measures 9 by 13 by 19 in. Vibration Measurement Engineers process the film and analyze and evaluate the recorded vibrations.

Gearmotors

ACCORDING to the Reliance Electric & Engineering Co., a new line of Reliance Gearmotors is now available



in both ac and dc from one through 60 hp. The new gearmotors reportedly combine the latest design principles of mechanical gearing and electrical motor development.

For more information write to Reliance Electric & Engineering Co., 1088 Ivanhoe Road, Cleveland 10, Ohio.

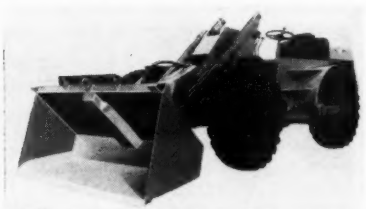
Lift Truck

THIS PNEUMATIC-TIRED TRUCK, the Hyster QN-20 of 2000-lb capacity at 24-in. load centers, is powered by an air-cooled Wisconsin gasoline engine. The complete line of Hyster hydraulic attachments can be readily mounted on the attachment carriage, and Hyster LP-Gas conversion kits are available.

For descriptive literature write to Hyster Co., 2902 N. E. Clackamas St., Portland 8, Ore.

Front-End Loader

FOUR-WHEEL STEERING, two axle oscillation and unimpaired operator visibility are features incorporated on the model LD5T Scoopmobile. The LD5T is a one cu yd, 5000 lb capacity front end loader, and will transport a full load with the



bucket raised off the ground merely enough to clear the terrain.

Complete, detailed information is available by writing the manufacturer, Mixermobile Manufacturers, Inc., Portland 20, Ore.

Storage Battery

ACCORDING to the manufacturer, this high output nickel cadmium pocket plate storage battery is proving outstanding for diesel engine starting, standby power, switch tripping and closing, and emergency lighting. The electrolyte is a solution of potassium hydroxide. It is claimed no corrosive fumes are given off on either charge or discharge.

For more information write to Nickel Cadmium Battery Corp., 72 Pleasant St., Easthampton, Mass.

Bearing Mount

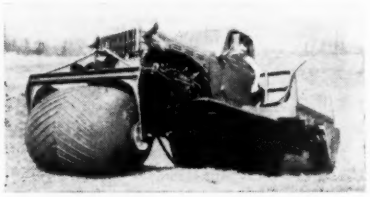
RECENTLY added to the SKF Industries, Inc., line of bearing mounts are the Type SYH-X Unit Pillow Block and Type FY-X Unit Flanged Mounting. The units are of the eccentric lock type and feature positive sealing, external rotating flinger to keep out dirt, a spherical outer ring to compensate for initial misalignment, and a convenient re-lubrication fitting.

For additional information write SKF Industries, Inc., Front St. and Erie Ave., Philadelphia 32, Pa.

Go-Anywhere Tires

THE Terra-Tire, a barrel-shaped, low-pressure pneumatic tire that can be powered through its axle by any conventional drive system, has been announced by the Aviation Products Div. of The Goodyear Tire & Rubber Co.

The tire can take trucks, trailers



and other off-the-road vehicles over all types of terrain and roadways, and speeds up to 65 mph have been achieved.

Through a hub and axle fitting, the tire receives its motive power directly from the engine. The soft pneumatics are available in a wide range of sizes.

Malfunction Detector

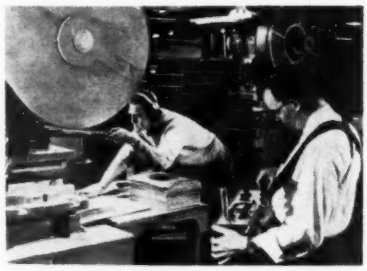
THIS VIBRATION MONITOR, called the Model 5 Vibraswitch, is said to anticipate and prevent trouble in rotating and reciprocating machines by responding to slight increases in roughness or vibration and causing a shutdown before a costly failure occurs. The unit includes a shock-free holding and reset mechanism for automatic or remote operation to prevent actuation from starting or from normal or accidental transient shocks.

The Model 5 is supplied in an explosion proof housing for Class I, Group D; Class I, Groups F and G locations, or gasketed for nonhazardous outdoor locations.

For additional information write The Beta Corp., Forest Ave. at Ridge Rd., Richmond 26, Va.

Sound Level Meter

CALLED the "Soundscope," this electronic instrument has been introduced by the Mine Safety Appliances



Co., Pittsburgh, to help combat industrial noise. The 20-lb instrument serves as a meter to measure over-all sound levels. It also operates as an analyzer, measuring sound in each of eight octave bands to determine noise peaks.

Rotary Drill

A HEAVY DUTY rotary drill for vertical blast holes in mining, quarrying and construction operations has been announced by The Winter-Weiss Co., manufacturers of the Portadrill line of truck, trailer and tractor mounted drills.

The Model 6TA is mounted on a Caterpillar D6 Diesel prime mover and utilizes compressed air for cuttings removal. Two rotary compressors, operating singly or together provide a maximum of 85 psi air pressure with normal drilling pressures of 15 psi. Up to 27,000 lb weight can be applied on the bit.

Complete specifications on the 6TA or other drills are available from The Winter-Weiss Co., 2201 Blake St., Denver 5, Colo.

Wagon

A MULTI-PURPOSE MOVALL WAGON for use with Caterpillar DW15 tractor has been announced by C & D Manufacturing Co., Perkins,

Calif. The Movall has a heaped capacity of 16 cu yd and a carrying capacity of 22 tons.

Known as the RD15 Movall, the "scraper-in-reverse" wagon has other features that include positive cable-controlled (out the rear) ejection, controlled spreading or dumping action, a turning width of 27 ft, and a loading target area 10 by 16 ft.

Radiophone

ACCORDING to the manufacturer, Private Line radio is designed specifically to maximize communications efficiency under congested channel conditions, and to eliminate operator fatigue, missed and misunderstood messages, and passenger annoyance—even in the presence of co-channel occupants

and on-channel nuisance and skip interference.

More information is available from Motorola Communications and Electronics, Inc., Technical Information Center, 4501 W. Augusta Blvd., Chicago 51, Ill.

Clamshell Bucket

A PNEUMATIC closing type clamshell bucket for use with single drum hoists has been introduced by Blaw-Knox Co., Farmers Bank Bldg., Pittsburgh, Pa. Having integrally contained power closing, both the ⅜ and ⅝-cu yd sizes are designed to accommodate either Ingersoll-Rand or Gardner-Denver air hoists.

Workmen control the operation of the bucket through open and close chains. The air hoist is so designed that when the chair is released the jaws of the bucket hold their positions. The upper structure is designed to permit mounting the air hoist directly on the vertical center line, giving the bucket symmetry and balance. The bucket operates on 85 to 100 psi.

Weighing System

AVAILABLE in capacity range from 5000 to 100,000 lb, the EC weighing systems are manufactured by The A. H. Emery Co., New Canaan, Conn. The Emery systems are claimed to be ideal for bin, tank, platform and conveyor weighing applications and also well adapted to the measurement of jet engine thrust, dynamometer power measurement, and wherever force or weight must be measured with optional remote dial indication. Systems can be used to measure, indicate and actuate control mechanisms for automatic operations.

Steel Mill Truck

THE K-48 LINE of 18,000 to 30,000 lb capacity electric powered steel mill trucks has been announced by the Yale & Towne Mfg. Co., 11000 Roosevelt Blvd., Philadelphia 15, Pa. They can be equipped with forks, a ram or a hydraulically operated split ram.

Important features include hydraulic power steering, hydraulic wheel brakes, "dead man control" motor brake, and dual operating controls.

The truck can be powered with a battery, diesel or gasoline engine generator power plant.

Fastening of Conveyor Belts

BELT FASTENING TOOLS, manufactured by Flexible Steel Lacing Co.,

4675 Lexington St., Chicago, Ill., have been made available to the industry. Flexco speed tools include power tool wrenches, and power tool boring bits or boring punches.

— *Announcements* —

Wm. B. Stephenson has been elected president of **The Allen-Sherman-Hoff Pump Co.**, succeeding **Homer E. Allen**, who will serve as chairman of the board of directors. Stephenson is succeeded as vice-president by **Fred S. Stow**, who will continue as chief engineer, with **Gordon Stieff** as assistant. **Donald G. Ashe** has been named assistant sales manager at the home office in Wynnewood, Pa. **Wm. M. Walters** is Central district sales manager with headquarters at the company's Chicago office, and **Robert M. Jensen** has been placed in charge of the company's New York office.

W. B. Stephenson

Francis D. Holden was recently elected vice-president in charge of sales for **Macwhyte Co.**

Gardner-Denver Co., has announced the appointment of **William B. Knoderer** as sales manager of the Industrial Division, and **Niel Martin Fishback** as sales manager of the Mining and Contracting Division.

J. C. Price Taylor was recently appointed manager of Crusher and Pulverizer Sales, **The Jeffrey Mfg. Co.**, Columbus, Ohio. He had been sales engineer for that division in the East and has been with the company 20 years.

The election of **Milton T. Smith** as president and general manager of **Marion Power Shovel Co.** and of its subsidiary, **The Osgood Co.**, has been announced by their Boards of Directors.

In his previous capacity of vice-president and general manager, he had served since March 1955 as chief executive officer of both companies, which operate as part of the Equipment Department of Merritt-Chapman & Scott Corp.

American Car and Foundry Division of ACF Industries, Inc., announces the appointment of **Herbert H. Rogge** as executive vice-president.

Joy Mfg. Co. has announced two additions to its executive staff.

A. B. Drastrup, formerly president of the **A. M. Byers Co.**, has been elected a vice-president and **Wm C. Campbell** has been named manager of Warehouse Operations.

Drastrup began his business career with the Harbor Authority at Copenhagen, Denmark, later joining U. S.

A. B. Drastrup

W. C. Campbell

Steel as an accountant in Gary, Ind. There followed a three-year period with Columbia Steel Co. at Torrence, Calif., after which he joined A. M. Byers in 1931. He was named president of the Byers company in 1954.

Campbell, until his new appointment, had been general sales manager and assistant secretary of **National Mine Service Co.**

CATALOGS & BULLETINS

CONCRETE GUNS. *Air Placement Equipment Co., 1009-11 West 24th Street, Kansas City 8, Mo.* This 16-page catalog gives complete details, specifications and operating capacities of the company's Nucretor, Bondactor and other Airplaco concrete gunning equipment.

GEARMOTORS AND MOTOGEARS. *Link-Belt Co., 307 North Michigan Ave., Chicago 1, Ill.* Book No. 2447 describes Link-Belt's line of Gearmotors and Motogears. It includes complete selection data together with features of construction, load classification, dimension tables, overhung load ratings and mounting assemblies.

INVITATION TO LEARNING. *Remington Rand Institute, 315 Fourth Ave., New York 10, N. Y.* Brochure X-1630 describes opportunities offered by the Remington Rand Institute to business executives who wish to enhance their knowledge of business systems and equipment. There are seminars for executives and department heads who are specifically interested in punched-card or electronic methods; seminars of top-level people from many firms who discuss general management problems; seminars for members of one firm who attack a specific problem.

MANGANESE-STEEL SPROCKETS. *Taylor-Wharton Division, Harrisburgh Steel Corp., High Bridge, N. J.* Brochure No. 1-56 describes Taylor-Wharton's line of manganese-steel sprockets and outlines the advantages of using sprockets with replaceable tooth segments.

MATERIAL HANDLING. *McNally Pittsburg Mfg. Corp., Pittsburg, Kans.* Bulletin 955 describes equipment for handling bulk material such as rock, gravel and coal. Information on conveyors, chain, feeders, elevators, hoppers and drives is included as are photographs, dimension drawings, data tables and specifications of the various pieces of equipment.

SCREENS. *Wickwire Spencer Steel Division of The Colorado Fuel and Iron Corp., 575 Madison Ave., New York 21, N. Y.* Bulletin describes the company's new line of Wissco-loy Space Screens including a standard list of specifications as well as recommended applications and suggestions as to ordering.

SECTIONAL BELT CONVEYORS. *Link-Belt Co., Dept. PR, Prudential Plaza, Chicago, Ill.* Book No. 2579 describes Pre-Bilt sectional belt conveyors in standardized, pre-engineered units with capacities ranging up to 1500 tph. Built in varying widths, the new Pre-Bilt conveyors incorporate standard Link-Belt components. Drives range up to 40 hp.

TROUBLE-SHOOTING CHART FOR HYDRAULIC SYSTEMS. *Sun Oil Co., Industrial Products Dept., 1608 Walnut St., Philadelphia 3, Pa.* This two-color wall chart is designed to help operators and maintenance men spot and cure common troubles in hydraulic systems.

V-BELT DRIVES. *Allis-Chalmers Mfg. Co., 972 S. 70th St., Milwaukee, Wis.* The origin, history and development of the modern multiple V-belt drive is discussed in booklet No. 20E8297. It also covers the evolution of standards in engineering V-belt drives, tells how to engineer a V-belt drive, provides tables and data, and describes modification in V-belt drives. The final chapter furnishes answers to a number of questions relating to some of the basic principles and practices involved in the engineering and use of multiple V-belt drives.

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